Engineering News-Record

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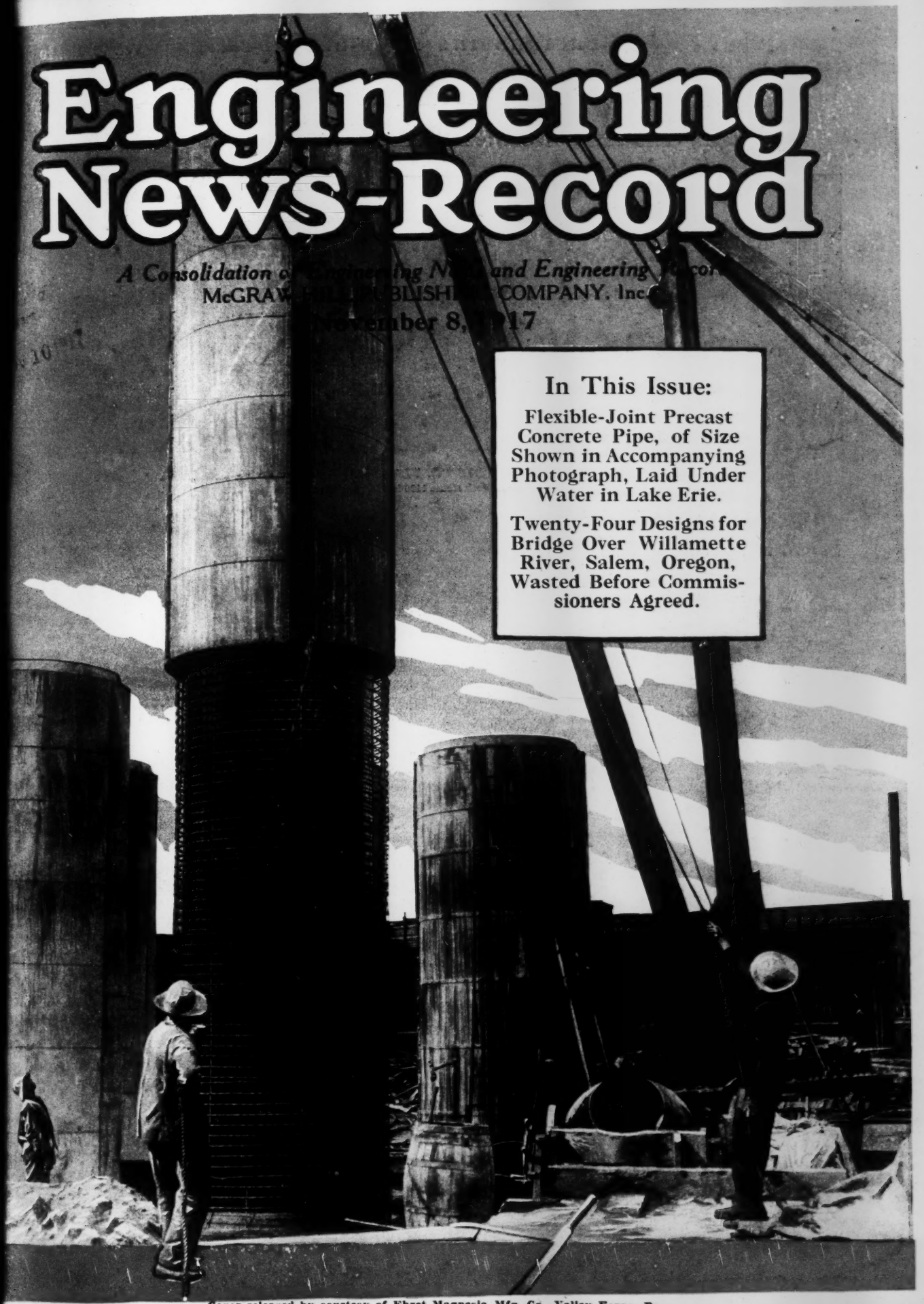
Flexible-Joint Precast Concrete Pipe, of Size Shown in Accompanying Photograph, Laid Under Water in Lake Erie.

Twenty-Four Designs for Bridge Over Willamette River, Salem, Oregon, Wasted Before Commissioners Agreed.



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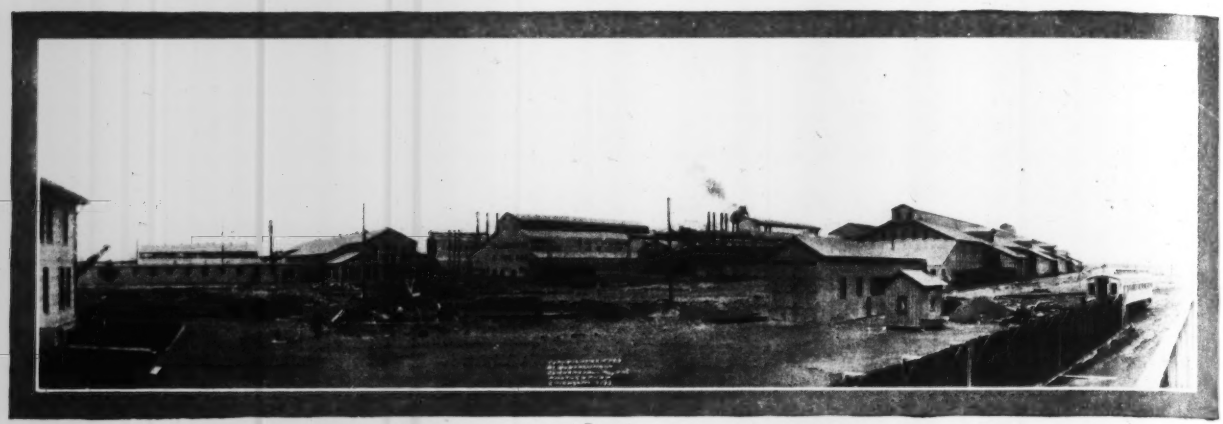
"The Indestructible Roof"



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ENGINEERING NEWS-RECORD

A WEEKLY JOURNAL
DEVOTED TO CIVIL ENGINEERING
AND CONTRACTING

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Strikes Discouraged by Executive Order

POSSIBLY the first instance in which the Government has lent its support to a plan whereby labor will be penalized financially for striking in violation of its agreement with employers is that involved in the raising of the price of soft coal announced by the fuel commissioner week before last. The increase was made in order that the wages of miners in the bituminous field might be increased, but it is specifically provided that the increase in prices shall not apply unless in the given district the miners and operators shall have made a contract providing for the collection automatically of fines for quitting work in violation of the agreement. The object in setting the fines is to secure full operation of the mines. While there are certain interesting labor phases connected with the matter, these are of little interest here. The main point is that the Government by executive order has resorted for the first time to the coercion of labor by supporting a money penalty. It is but another evidence of the extent to which previous policies are being upset by war emergency. Even labor, recently most carefully nursed by the Government, must feel the strong executive arm when the nation's life is in peril.

Full Information for Bidders

IN HIS letter on page 895 of this issue, Mr. Adams argues soundly when he makes a plea for contract advertisements which give full information to intending bidders. Executives with work to let will do well to follow the suggestion made. In advertising for bids on proposed contracts these officials often fail to put themselves in the position of the man who depends upon a brief printed statement in making the decision as to whether or not the work is suitable or profitable for him to undertake. The point is that the municipality, state or other public or private organization with work to be done must adopt, in a measure, the methods of a salesman. It must "sell" its contract. This result can never be achieved while there remains doubt as to the size or general character of the job, for no contractor, unless he is starved for work, will take the trouble to investigate construction proposals unless it is made reasonably clear to him just what he is expected to do, how much of an organization and what quantity of plant will be required to put the job through and return a profit to him. The preparation of advertisements for contracts should not be placed in the hands of some clerk with no appreciation of the engineering and construction features involved. These advertisements should be carefully written by an engineer who should ask himself the question, "What information would I require before deciding to put in a bid on this job?" The writer of the advertisement should then proceed to answer this question in the writing of his proposal. The object of advertising such proposals is to induce as large a number of contractors as possible to bid upon the work. The advertisement which gives a contractor the information he really wants will bring inquiries from the right kind of men and will be a big factor in getting rock-bottom prices.

Board Reports on British Road Conditions

IN THE report of the British Road Board for the year ending Mar. 31, 1917, reprinted on page 873 of this issue, American engineers will find data upon which to base an interpretation of what three years of war has meant to British highways. The usual funds for new construction and for maintenance have been greatly curtailed, while the necessary amount of labor has not been available for new work or repairs. These two factors, lack of funds and lack of men, are combined with another—great increase of heavy motor traffic connected directly or indirectly with military operations. This combination of influences, it can readily be appreciated, has been a trying one for the British roads. Practically no new construction or much-needed reconstruction has been undertaken, and maintenance has been very largely reduced. In the light of these conditions it is significant to learn from the Road Board that "experience has shown that it is less costly to highway authorities, in the long run, to construct roads of a suitable type for the traffic rather than to continue the use of methods and materials which have become antiquated." Of course, one outcome of the English conditions is that huge volumes of deferred maintenance and construction work are piling up day by day. This means a vast road-building program after the war, if the necessary money for financing the work can be secured.

An Opportunity for Road-Building Leadership

THE disbanding of the American Highway Association, noted in the news section last week, and in the historical sketch by Mr. Goodell on page 870 of this issue, presents to the American Road-Builders' Association an opportunity for uncontested leadership of national scope. The existence of two national associations in the highway field in the past resulted in a more

or less divided allegiance of United States road-builders. With their two annual conventions, two road-building exhibits, and a certain amount of natural jealousy thus engendered, the full force of united effort was not realized. Today the situation is altered. There is but one national road-building association. Its field for constructive effort, for leadership in work which is, day by day, assuming tremendously increased importance, is practically unlimited. The affairs of the organization must be directed by strong men, by men of broad vision, by men who have no ax of their own to grind in the handling of the association's affairs. Only with such men occupying each of the administrative posts in the American Road-Builders' Association can real progress be made. The association, last week, made an auspicious start by electing to its presidency H. E. Breed, first deputy commissioner of the New York State Highway Commission. But the work to be done is not a one-man job. It will require the best thought of the best men in the field of highway engineering and road construction. Times are changing. Conditions under which road-building is carried on have given birth to new and perplexing problems. Unstable and rising markets in labor and materials have saddled enormous loads upon highway contractors. Federal participation in state-road construction on a large scale is in effect, with a consequent expansion of the responsibilities of all those engaged in this work. And now, with all of these weighty matters on hand, comes the embargo of the Priority Board on open cars for the transportation of "materials and supplies, other than coal, for the construction, maintenance, or repair of public or private highways, roadways, streets, or sidewalks." Surely never in the history of American road-building did conditions call more clearly for prompt, united effort and sound constructive thought. Upon the American Road-Builders' Association now devolves a serious duty and a great opportunity.

Advice to Turbine Purchasers

HYDRAULIC-POWER promoters have made some serious mistakes as the result of their inadequate knowledge of the heart of their project—the turbine. Common practice in selecting turbines for a given place neglects expert advice until a mistake is evident. "Expert" here does not apply to the advice of an engineer capable merely of making an analysis of Holyoke model-test data; he must have an understanding also of the actual processes of runner design, and knowledge of what data he must secure from the builder to scrutinize the parts.

The strength of a turbine builder's sales department often goes farther to establish him in a locality than the ability of its designer. Flume tests are made much of; but such tests, unless made of the particular runner offered, will not protect the promoter unless he can fully consider the effect of changed conditions between test setting and actual setting.

Three coördinate lines of search are required to meet the engineer's needs: One is the study of Holyoke tests on homologous model runners; another requires check computation of the principal dimensions fixed by hydraulic theory; and the third is a scrutiny of the little-appreciated but very important art of getting smooth eddyless flow along fair curved surfaces inside the turbine runner. How this last scrutiny can be made may be inferred from the steps in runner layout so interestingly set out in elementary form by an experienced turbine designer on page 845 of last week's issue.

But such an article—even plus the after studies some engineers will be led to pursue—cannot qualify everyone to pass judgment on an important turbine design. It will be advisable to employ someone as a consulting expert—just as one would for other highly specialized and complex apparatus.

Shall Engineering Courses Be Made Shorter?

AS AN OFFSET to the attractiveness of industry under present conditions, Princeton University's civil engineering course has been shortened from four to three years, students taking the three-year course covering about 93% of the actual number of credit-hours of the regular four-year course. The number of hours of work a week will remain about the same, but the candidates for a degree in the shorter course will be required to put in two summer terms of nine weeks each at the close of their freshman and sophomore years, this extra time being occupied in much the same way as similar hours during the regular terms except that a larger proportion will be spent in field work and drawing.

While the announced intention is to discontinue this abridged course at the close of the war, the possibilities of time-saving opened up by this experiment may throw a new light on the whole question of the requirements of technical education. In contra-distinction to this shortened course, some of the coöperative courses and engineering courses in schools requiring a year or more of work toward an A. B. degree call for more than the standard four years' work preliminary to even a B. S. degree. The quality of graduates turned out by schools following one or another of these schemes is something that is not easily determined—in fact it may be said that the question is actually indeterminate, for as yet we have no method of standardizing men and no way of measuring with any degree of precision the efficiency of a definite type of training or even the efficiency of personal effort.

But this fact remains: Study, as such, is not a process that can be carried on continually. Education is not work in the sense that the word "work" is used in the business world. There is no day-to-day repetition of the same task modified only by different circumstances, but there is a perpetual absorption of new and always more complex ideas which, to be of use, must be articulated with what has been learned before. This requires more frequent and longer periods of leisure, and makes "cramming" not only of very little actual permanent value, but usually a detriment when the final results are measured.

The experiment will be watched with extreme interest. No doubt there are many who would be better served by a course of three years even though it did not lead to a degree, for there are branches of engineering and industrial applications of engineering where the full training of an engineer is not demanded. It is possible to conceive that the ultimate form of

technical training, considered nationally, may call more rationally for courses ranging from two to as many as six years, rather than a standardized course of four years leading to a uniform degree, and it is under just such critical conditions as are forced by war that these experiments will be undertaken and the advantages or limitations of technical educational systems developed.

On Germany's Footing

GERMANY today is the best example of a whole nation at war. England and France's military machines may be equal to or greater than Germany's. The people at large, however, have not been asked to make the sacrifices that are the lot of those of the chief Teutonic nation. There every thought is of war. Every energy is bent toward its winning.

Today we are still far from the conflict. Our boys are in touch with the enemy, but there has been no serious engagement. The war imposts have only now gone into effect, and the big taxes will not be collected until the spring. Food is high, but there is no serious shortage. The Liberty Bond, food conservation and Red Cross campaigns more nearly indicate the seriousness of the conflict than any other war incidents. The congressional appropriations so baffle the imagination as to make but little impression. Moreover, the individual fails to translate them into terms indicating his personal liability.

We have so long been a peaceful nation that it is difficult for us to change our lives quickly to conform with military needs. The making of the change is an educational process, in which the engineer and the contractor, as centers of influence, can play a very important part.

With the utmost expedition we must get on a war footing similar to Germany's. We need not endure the same food privation, but war must be uppermost in our thoughts, so that we may voluntarily deny ourselves so far as needed, or submit in a thoroughly coöperative way to imposed food restrictions. What applies to food, applies also to fuel, taxes and other war regulations or measures.

We advocate quick change to Germany's base, not because of any doubt about the ultimate result of the conflict. *We will win*—that is certain. But every day we shorten the conflict will bring back to us unhurt those clear-eyed, virile young men whose faces are turned toward France or who are already there. If we could save one of these lads, nothing would stop us. Yet, we can save not one but many by shortening the war.

In our organizations we can see to it that our men realize the necessity for food saving, for stopping all unnecessary purchases (for they take labor from war industries), for investment in Liberty Bonds. Our associations and clubs have no right to proceed with ordinary business until they have secured the pledges of their members to every measure of conservation and national aid.

So shall we, enginers and contractors, be doing our part in bringing home to the people of the land the need for getting on Germany's footing. The reward for our support will be lives—precious lives, lives of brave young Americans, possibly of our own sons or brothers.

A Highway War Board and Priority Order No. 2

PRIORITY Order No. 2 leaped into extraordinary notoriety in the last week. It came unexpectedly. Road officials and road builders had been looking on their work as a real war emergency. All the more violent was the shock, therefore, when at five days' notice that work was forced to a standstill.

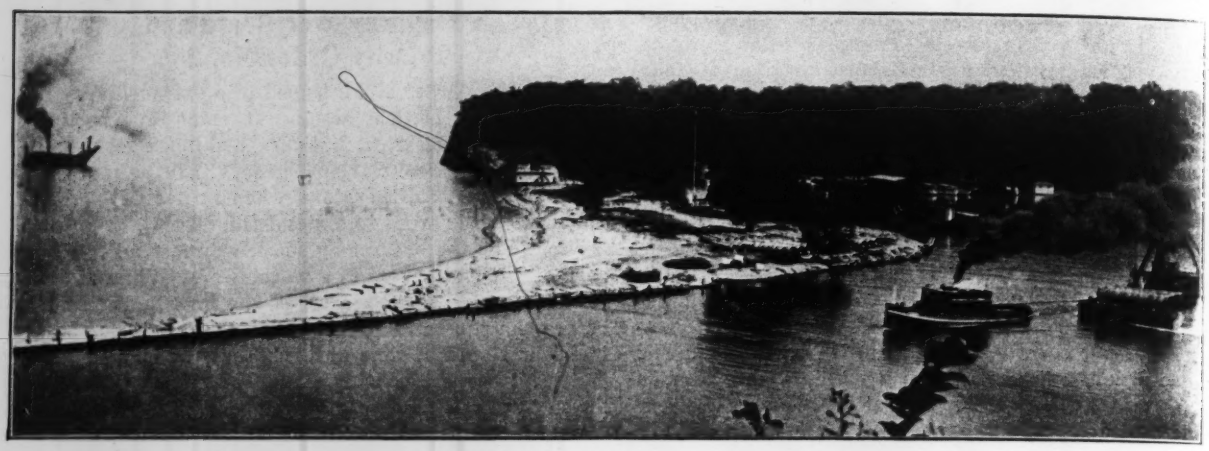
Drastic as the order may seem, we must accept it as part of the penalty of the world war. While full information as to the character of the investigation made before the promulgation of the order is not forthcoming, it is stated in general terms that the whole subject had most earnest consideration, the claims of various lines of work being carefully weighed.

Two thoughts stand out very clearly in a consideration of the situation: (1) That there is hope for the amendment of the order by the introduction of some measure of flexibility; and (2) that we need at once a highway war board, which will consider from the war angle in all aspects highway transportation and its allied problems of highway construction and maintenance.

We base the statement that there is hope for the introduction of some degree of flexibility into the order only on general grounds. We have no authority or even "unofficial" suggestion that such modification is in contemplation. On the contrary we gather the rather plain implication that the board expects the order to stand for the winter, though it is intimated that it will be rescinded early enough in the spring to allow highway work to proceed. Nevertheless, looking at other government war measures, and realizing the urgency of many highway situations, we feel that the board will before long see the necessity of allowing certain road projects to go forward. Secretary Redfield, in explaining the Trading with the Enemy Act to the Editorial Conference of the Associated Business Papers, said that the principle underlying it was the erection of a tight wall absolutely prohibiting commercial intercourse with the enemy, but that in this wall were many gates, which might be opened as conditions dictated. So, too, we conceive Priority Order No. 2. It stops all road-materials transportation in open cars. Will there not soon be gates in the order for needed shipments.

The other outstanding thought is that we need at once a highway war board, along the lines advocated in the *Engineering News-Record* of Sept. 27. We do not need here to repeat the arguments for it or to point out its scope. The seriousness of the railroad situation is generally appreciated. We must know all our resources and have them in usable shape to meet emergencies. Therefore, we must know how the highways can relieve railroad congestion, and have them ready to render service when the crisis comes. We are reliably informed that the Council of National Defense is considering the appointment of such a board. Its favorable decision can come none too soon. Winter is approaching and with it an avalanche of traffic such as our carriers have never experienced.

Moreover, such a board, ably constituted and vigorous in management, would place before the Priority Board and other branches of the Council of National Defense a true picture of the place of the highway in the war scheme. No other agency or plan can do it.



TUG AT RIGHT TOWING BARGE LOAD OF REINFORCED-CONCRETE PIPE OUT OF MOUTH OF ROCKY RIVER TO SITE OF OUTFALL SEWER, JUST AROUND THE STRIP OF LAND WHERE DREDGE IS DIGGING TRENCH

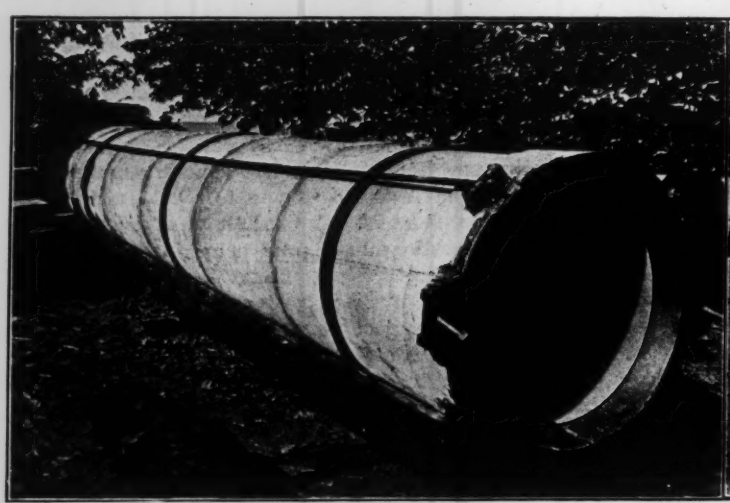
Flexible-Joint Precast Concrete Pipe Laid Below Water in Lake Erie

At Lakewood, Ohio, Flexible Joints Are Iron Castings and Sections Comprise Five Concrete Pipes—At Cleveland Single Pipe with Concrete Ball-and-Socket Ends Were Substituted

AT BOTH Lakewood, Ohio, and Cleveland there are now being laid outfall sewers, extending into Lake Erie, in which a new design of flexible joint has been applied to precast reinforced-concrete pipe. In both places the pipe are cast on shore, floated out on barges and sunk in previously made trenches. There they are set in place by a diver in sections so jointed as to permit movement due to foundation settlement.

The trench bottoms are situated in ground sufficiently solid to permit putting in the outfall pipe without the interposition of piles, but the irregular bottom made some flexibility of joint indispensable. For the earlier of the two jobs, that at Lakewood, alternative steel and concrete pipe-line designs were made; but the prohibitive cost of metal led the engineers to accept the bid on the concrete pipe, the novel details of which were worked out for this job by the Lock Joint Pipe Co. of Ampere, N. J. The Cleveland sewer was designed after the success of that at Lakewood was assured, and a concrete pipe line of somewhat similar but improved type, devised by the same company, was accepted without competition by steel or cast-iron pipe, the cost of which was then almost prohibitive. In this later design, however, even the metal spigots and bells of the Lakewood type were avoided, and the joint was made in concrete cast to the proper shape.

The first of the two lines is an outfall from the sewage disposal plant of Lakewood, a suburb of Cleveland. This line is 1500 ft. long, connecting just inside the shore line with a 36-in. reinforced-concrete sewer some 10 ft. below ground, and running in trench cut in the shale bottom of the lake to a maximum water depth of



BELL END OF ONE OF THE COMPLETE LAKEWOOD SECTIONS

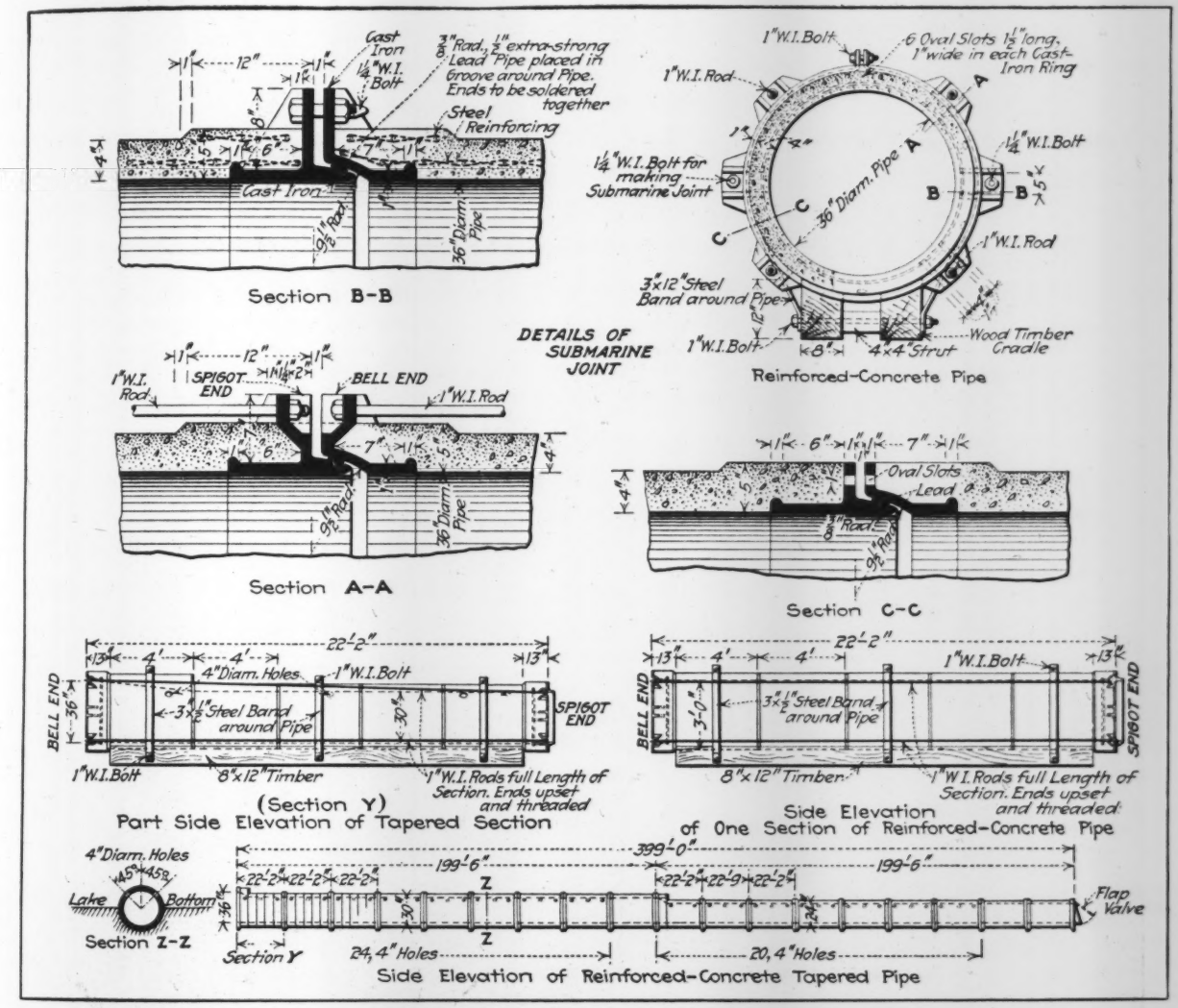
SPIGOT END SECTION OF 36-INCH PIPE

about 20 ft. The first 1100 ft. of the pipe is 36 in. inside diameter, and the last 400 ft. decreases to 24 in. The end is provided with a flap valve, and the whole 400-ft. section has 4-in. perforated holes to disperse the effluent.

The pipe units are each 22 ft. 2 in. long, made up of three 4-ft. lengths of ordinary "Lock Joint" reinforced-concrete pipe, with the regular poured joint, and two end sections, one having a cast-iron bell and the other

contact with each other when the short tie bolts are drawn up and form the joint which permits movement of the pipe around the tie-bolt diameter in case of any settlement in the foundations. The joint is made tight further by a ½-in. lead pipe gasket which is sweated around the spigot casting in a groove provided for it.

The separate small pieces of pipe are all cast at a plant at the mouth of the Rocky River, just adjacent to the outfall site. The five separate pieces for each sec-

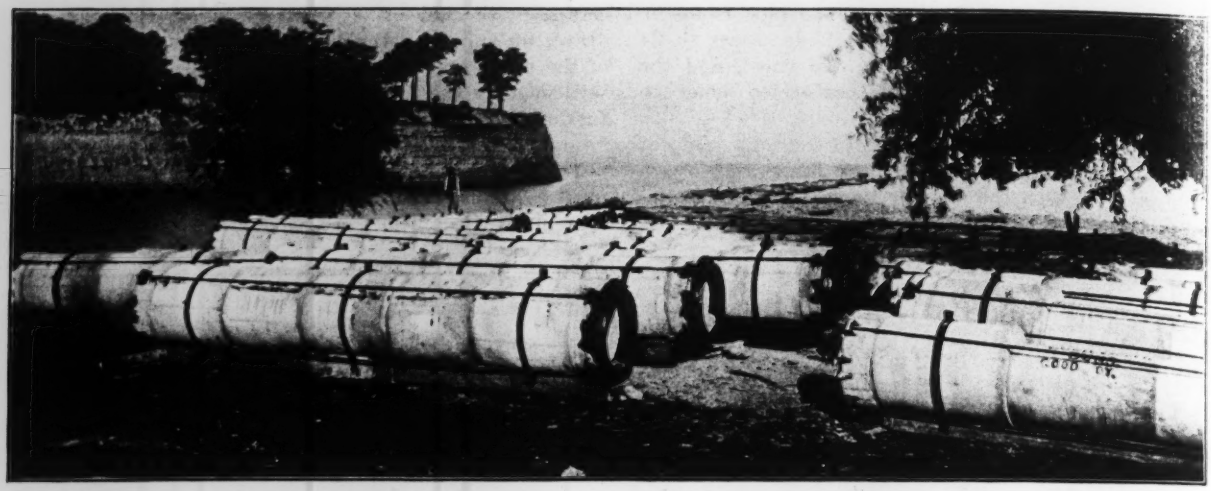


FLEXIBLE-JOINT REINFORCED-CONCRETE PIPE DESIGNED FOR OUTFALL SEWER INTO LAKE ERIE AT LAKEWOOD

a cast-iron spigot. These castings are placed in the bottom of the form in making the pipe, and are tied in to the reinforcement of the shell. They also are provided with offsets reaching up into the concrete to insure a tight connection between the concrete and the casting. Each bell and spigot casting has four lugs, through which 1-in. rods tie together the five pipes into one unit. Each casting has also two diametrically opposed lugs through which short 1¼-in. bolts are passed after the pipe is lowered into the water to make a connection with the adjacent pipe. The bell and spigot castings have opposing spherical surfaces which come in

tion are then assembled on a cradle of two 8-in. timbers which are strutted and tied together at the proper spacing, and which have upper faces adzed off to the curve of the pipe. The joints in the intermediate pipes are then poured and wrought-iron bands bolted through the timbers are tightened around the tops of the pipes to hold them fast to the cradle. The longitudinal tie-rods are then inserted and brought to bearing and the section is ready to be placed. Assembled pipe sections are shown in the accompanying views.

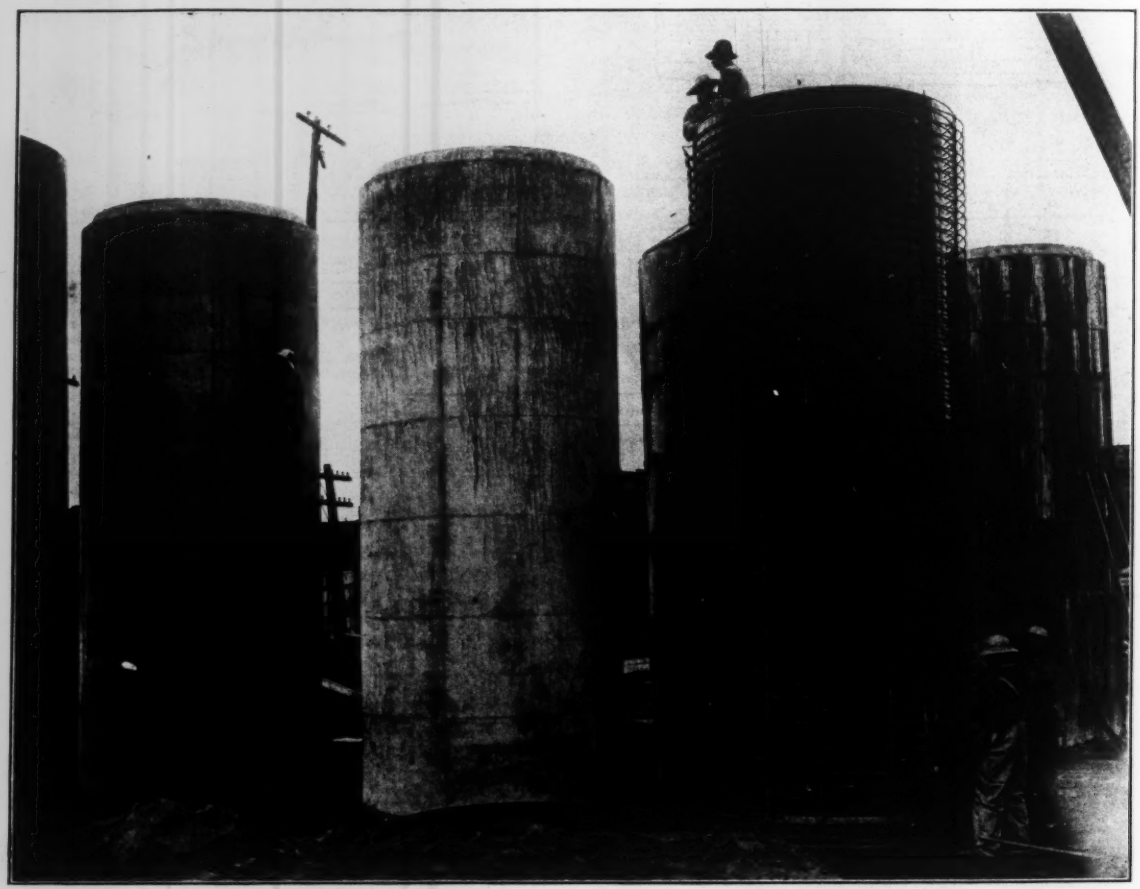
The 400-ft. tapered portion of the pipe is in two sections, the first 30 in. in diameter, and the last 24



REINFORCED-CONCRETE PIPE SECTIONS READY TO BE FLOATED OUT TO PLACE

in. in diameter. The step is made at the initial pipe of each section, and all the remaining pipes in that section are standard 30-in. or 24-in. pipe, as may be required. Except for this change, and for the 4-in. holes to let the sewage out, the details of the tapered section are the same as for the full section.

The work of setting the pipe was begun during the past summer and has progressed very favorably. As shown in the general view herewith, the pipes are kept on the strip of land between the mouth of the Rocky River and the lake. They are loaded on a derrick barge and towed to place at the outfall, where they are



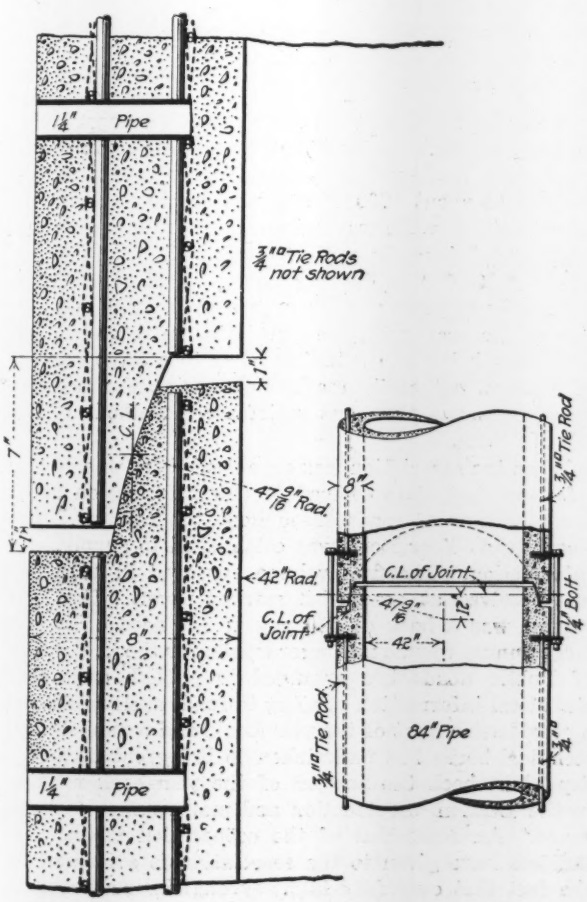
CONCRETE PIPE SEVEN FEET IN DIAMETER AND TWENTY FEET LONG TO BE USED FOR SUBAQUEOUS SEWER IN CLEVELAND

lowered into place from the derrick, being suspended by a two-way line. A diver working below sets the bell and spigot together and brings the tie-bolts, which are in the horizontal axis of the pipe, to a tight bearing. Inspection of the pipe so set has shown that the lead pipes were squeezed practically tight by the action of the bolts. The 22-ft. lengths of concrete pipe are very rigid and show no appreciable deflection when being hung from the two-way line. The diver is able to set from four to six pipes a day, working in 15 to 20 ft. of water.

The Lakewood outfall work is under the direction of E. A. Fisher, city engineer, and R. Winthrop Pratt, consulting engineer. The work is being done by the American Construction Co., of Cleveland, and the pipes were designed and cast by the Lock Joint Pipe Co., of Ampere, New Jersey.

Cleveland Outlet Has Concrete Joints

The Cleveland outlet sewer is being built by the city at the foot of East 140th St. Here the pipes are very much larger than at Lakewood, being 84 in. in diameter. On account of this large diameter, it was felt that they could be cast safely for their full length in one operation, so the intermediate joints have been dispensed with. Each pipe is 20 ft. in length and is cast on end near the site.



CLEVELAND OUTFALL SEWER PIPE HAS CONCRETE BELL AND SPIGOT CAST TO HEMISPHERICAL CURVE

It was also found in the Cleveland work, which has just been begun, that the cost of castings was so high as to require some other device for the bell and spigot joints. The one shown in one of the drawings herewith was adopted. In this it will be seen that the hemispherical contact surfaces of the Lakewood joint are obtained but that they are of concrete. To make this joint it was necessary to have forms of cast-iron specially machined true to line and surface. These were placed in the bottom of the pipe forms and the concrete of the pipe shell poured upon them.

The tie between adjacent pipes is also somewhat different in the Cleveland pipe. A 1¼-in. iron pipe is set in the shell of the concrete pipe to a depth of about 6 in., and about 8 in. from the end of the pipe. In these pipe threads are tapped and eye-bolts screwed in and through the eyes of these latter bolts 1¼-in. tie-bolts are passed. In order to take up the reaction of these tie-bolts, however, the vertical iron pipes carrying the eye-bolts are held together through the 20-ft. length of the pipe by one ¾-in. rod hooked around the pipe insert and imbedded in the shell of the concrete pipe. It is intended to put a heavy asphalt paint on the hemispherical faces of the joints, so when they are brought to bearing there will be a certain amount of the asphalt squeezed out to form a tight joint.

This pipe line is 3400 ft. long, 2400 ft. of which is to be 84 in. diameter and the last 1000 ft. to be tapered down in the same manner as is the Lakewood pipe, to a minimum of 48 in. The pipes are now being cast but none of them has been set.

The work is under the direction of Robert Hoffman, chief engineer of the City of Cleveland, the Lock-Joint Pipe Co. being the designers and makers of the pipe.

Draining Country Roads with Dynamite

The Missouri State Highway Department issued recently a bulletin pointing out the advantages under certain conditions of using dynamite to improve the drainage of wet places on country roads. The department protests against throwing rocks into soft mud holes, because the result of doing this is usually the production of a mud hole at each end of the place where the rock is dumped. If water is in a roadbed it must be drained away; dumping rock into the mud increases the area which is wet by the water in the soil.

The department points out that in many cases the water is retained by a bed of clay or hardpan resting on a stratum of gravel or other material through which the water can trickle away readily. All that it is necessary to do to draw away the water from the roadbed is to give it an opportunity of passing through the impervious layer into the gravel below. It is recommended therefore that holes be dug in the clay and a charge of dynamite placed in the bottom of each. By exploding this dynamite a well will be formed at each hole through which the water in the roadbed will be drained into the gravel. This work should be done carefully so that it is certain the dynamite will clear away a hole reaching down into the stratum through which the water will pass away. After the hole has been completed it should be filled with coarse stone or gravel or some similar material, so that the dirt will not seal it and destroy its usefulness in a few months.

The American Highway Association and the Mission It Fulfilled

Intelligent Interest in Road Improvement in United States Due Largely to Efforts of Body Disbanded Last Week

By John M. Goodell
Executive Assistant, American Highway Association, Washington, D. C.

THE RAPID development of an intelligent interest in road improvements in this country has been due in a considerable degree to the work of the American Highway Association, which was dissolved on Oct. 30 by its board of directors, the purposes for which it was founded having been attained. Few of those now interested in the wise administration of public funds for road betterments realize the very unsatisfactory conditions existing when this association was organized and the full measure of the services it has rendered to the country and the several states.

The manner in which the association came into existence affords a good idea of road-building conditions in 1900. The director of the United States Office of Public Roads, Logan Waller Page, and B. F. Yoakum, head of the Frisco Railway System, were returning together from a road convention in Oklahoma. It had been characteristic of many of the road meetings of that date, of no real constructive value. There were then a few persons who were making considerable sums by organizing so-called national road congresses and keeping the contributions received from cities where the meetings were held and from commercial interests for the use of space for exhibits. Some of these meetings were conducted properly, but others were notoriously bad. Messrs. Page and Yoakum, who realized that road improvements were in danger of falling into disrepute on account of the exploiting, by unscrupulous persons, of the public interested in such work decided that the conditions demanded an active national society with prominent men as its officers, which would of necessity be recognized as a real American highway association, and thus be able to assist all those local organizations which were striving to accomplish good work and bring to an end the activities of the undesirable promoters.

Organized in 1910

Accordingly, an invitation was issued by Mr. Page to many men interested in road improvements to meet in Washington on Nov. 23, 1910, to organize such a society. Among those present were the late W. W. Finley, president of the Southern Ry.; James S. Harlan, of the Interstate Commerce Commission; the late Alfred Noble, to whose memory as a great civil engineer a monument will shortly be erected in Washington; Hennen Jennings, the eminent mining engineer; the late Bryan Lathrop, whose public-spirited work for park improvements in Chicago gave him a deep interest in road affairs; Leonard Tufts, whose development of Pinehurst, N. C., had led him to appreciate the importance of good roads in backward sections; Joseph W. Jones, whose inventions in connection with phonographs and speedometers are widely used; and the late Lee McClung, then treasurer of the United States. At this meeting the American Highway Association was organized "to harmonize and correlate all efforts for the improvement of the public roads, to the end that adequate and efficient systems of road construction, administration and maintenance may be adopted in all of the states."

The association opened offices in Washington. It soon had the support of such prominent railway presidents as Louis W. Hill, of the Great Northern system, James McCrea of the Pennsylvania system, W. C. Brown of the New York Central system, and L. E. Johnson of the Norfolk & Western system. An early achievement was the organization of good roads trains, which were run through many of the Southern and Middle Western states with the coöperation of seven railway companies and the U. S. Office of Public Roads. These trains were provided with photographs, models and lecturers, and the dates of their arrival at the towns where stops were made were advertised in advance. The technical and economical features of road construction and maintenance were explained, and in many cases local good road associations were formed. The cooperation of railway companies in the work of the association has been a feature of its career. Fairfax Harrison, president of the Southern Ry., had been its president for several years prior to the dissolution, and L. E. Johnson, president of the Norfolk & Western Ry., was an active director for some years.

Good Roads Trains

The direct personal work with the people in many states which was carried on with the good roads trains was supplemented a little later by articles prepared for the newspapers. At the time of the dissolution of the association this work had developed so that a weekly bulletin of about 1700 words, relating to various features of road work, was being sent to newspapers and agricultural journals with a combined circulation of nearly 9,000,000 copies per issue. This service was given only to papers which requested it. The coöperation of the press with the association in this work has been very helpful in bringing home to a large number of persons, not easily reached otherwise, the value of good roads and the most satisfactory methods of obtaining them.

When the association was organized there was no satisfactory up-to-date compendium of information about the condition of roads throughout the country. The Good Roads Year Book was established to supply such information. The first volume appeared in 1912 and was received at once with marked favor. The 1917 volume was a book of 550 pages; the need of such a large annual volume no longer exists, for the U. S. Office of Public Roads has arranged to publish each year statistical information relating to roads such as formed a considerable part of the year book, and a publisher of technical books has undertaken to bring out as an independent book the portion of the year-book relating to the location, construction and maintenance of rural roads. An indication of the coöperation which road builders have given to the association is evidenced by the fact that over fifty highway engineers assisted in the compilation and revision of the technical information referred to.

An indirect work of the association which proved of decided value was the organization of an annual American Road Congress. Each congress was an independent undertaking, with its own officers and financial management. The purpose was to improve, by example, the character of the national road meetings which had been held previously and this object was accomplished. The first of these gatherings was held in Richmond, Va., in 1911, and the others in Atlantic City in 1912, Detroit in 1913 and Atlanta in 1914. In 1915 the association coöperated with the American Road Builders' Association in holding the Pan-American Road Congress in Oakland, Calif. The Atlantic City Congress was the first really successful national gathering of road builders and users in the country, and the impetus it gave to such conventions virtually made the old, irresponsible gatherings obsolete. There are other organizations which have lately demonstrated their ability to hold successful road congresses and there is, therefore, no longer any reason for the American Highway Association to continue such work.

From the outset, the association took an active part in assisting legislatures which were considering the enactment of road laws. Every year help of this sort was requested. After the passage of the Federal-aid road law in 1916, making it obligatory for a state to have a responsible highway department before it could obtain financial assistance from the national government for road improvements, the requests for such assistance became so urgent that a special report on state highway department legislation was prepared under the direction of R. Walton Moore, chairman of the association's committee on legislation. An edition of 6000 copies of this pamphlet was quickly exhausted, being distributed widely.

Highway Prize Established

With the organization of a highway department in each state, a great enlargement of the activities of the United States Office of Public Roads, and coöperative road building by the nation and the several states, the objects for which the association was founded had been virtually attained. The directors therefore decided that, rather than undertake new lines of work when the energies of every citizen are directed toward the successful prosecution of the war, the organization should be dissolved. The surplus funds have been invested in Liberty Bonds and will be employed in establishing the American Highway Association Prize, to be awarded annually by the Secretary of Agriculture for conspicuous service in the advancement of road improvement in the United States.

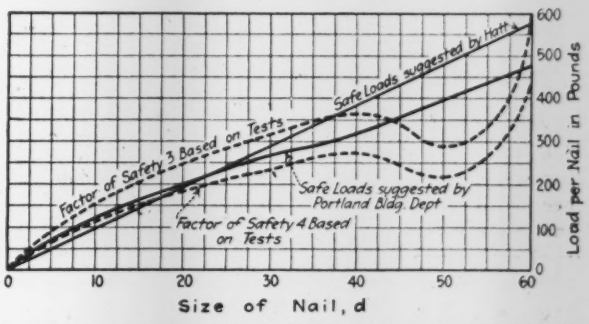
To Prevent Embankment Slips

Heavy rains last year caused considerable damage to the slopes of the north dike at the Ashokan reservoir, where the Catskill water-supply for New York City is collected. Top soil was shoveled down the slope into place to repair the damage and as a preventive measure against further slipping, 2-in. square stakes 3 ft. long were driven firmly in place, spaced 2 ft. apart in rows 5 ft. apart, parallel to the center line of the dike. One-inch boards were nailed to these stakes, the upper edge being left about 1½ in. below grade.

Tests on Nailed Joints in Fir and Hemlock Timbers

Building Bureau of Portland, Oregon, Establishes Safe Loads for Woods Commonly Used on Pacific Coast

THE FEW TESTS on the strength of nailed joints in timber which have been made public are all on varieties of timber generally found and used in the Eastern States. In order to check these figures with those for Western woods more generally used, the bureau of buildings of Portland, Ore., conducted recently a series of tests on nailed joints, using Douglas fir and western hemlock, the timbers most used on the Pacific Coast, and further inland of late, for building construction. Report has been made on these tests covering 110 joints, 87 of which were of Douglas fir and 23 of western hemlock, the tests all being designed to show the strength of nailed joints with wire nails used in single shear.



SAFE LOADS FOR NAILED JOINTS OF OREGON FIR AND WESTERN HEMLOCK

Nails driven perpendicular to grain. Load perpendicular to length of nail

The tests were divided into two series, depending on the style of the joint. In the first, two sidepieces, each with the grain of wood vertical, were nailed to a centerpiece with the grain of wood horizontal. In the second, two sidepieces, each with the grain of the wood vertical, were nailed to a centerpiece with the grain of the wood also vertical. In both series both Douglas fir and western hemlock were tested, but in the second series only Douglas fir was used. The sizes of the sidepieces varied from 1 x 6 in. to 3 x 8 in., and those of the centerpieces from 4 x 6 in. to 6 x 10 in., the dimensions indicating commercial sizes which vary from ⅜ in. to ¼ less than dimensions given. The nails were common wire nails ranging from 10d. to 60d. in size, and the number of nails used in each sidepiece varied from two to five. The sizes of the pieces were such that the nails had a penetration in the centerpiece of 30% to 80% of the length of the nail, but the nails were used in single shear, in no case passing through the centerpiece. All timbers were surfaced, so that contact in the joints was between planed surfaces only.

Tests were made, as shown in one of the accompanying views, by placing the blocks in a testing machine and forcing the sidepieces down and alongside of the centerpiece. Measurements were taken on the relative movement of the pieces by means of a scale screwed to the blocks, as shown in the view. An effort was

NAILED BLOCKS JUST BEFORE BEING TESTED IN MACHINE

made to measure the elastic limit of the joints, but this could not be determined so it was not recorded. The ultimate loads carried in the series were as follows:

RESULTS OF TESTS ON WOOD JOINTS TO DETERMINE HOLDING POWER OF NAILS

	No. of Tests	Size of Nail	Ultimate Load Carried per Nail, Lb. per Sq.In.
Series 1—Douglas Fir	14	10d.	525
	9	16d.	600
	10	20d.	749
	10	30d.	922
	5	40d.	1,183
	1	60d.	1,800
Series2—Douglas Fir	5	10d.	407
	9	16d.	628
	12	20d.	751
	6	30d.	992
	4	40d.	1,023
	1	60d.	873
Series 2—Western Hemlock	6	10d.	519
	4	16d.	588
	7	20d.	695
	6	30d.	979

This tabulation shows the irregularity and apparent unreliability of the single test made on the 50d. and 60d. nail joints.

On the basis of these tests the department established safe values for nails driven in perpendicularly to the grain in either Douglas fir or western hemlock, with the load perpendicular to the length of the nail, as follows:

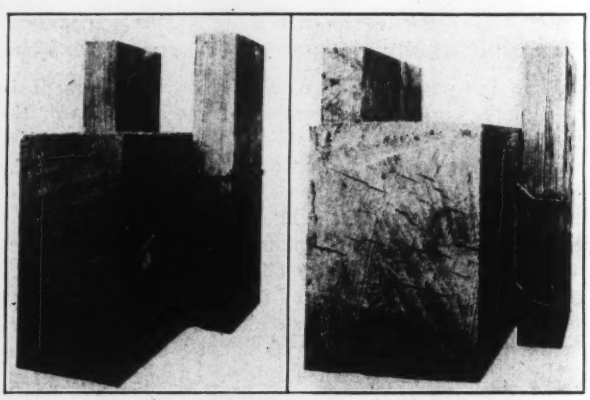
Penny Nail	Load Value per Nail, Lb.
10	120
12	120
16	160
20	200
30	270
40	320
50	400
60	480

From the accompanying diagram of the loads based on two factors of safety and the suggested safe load, it will be seen that the suggested safe load is about according to the formula $W = 7d + 50$, where W is the safe working load, per nail in pounds and d is the penny designation of the nail. It is interesting to compare this value with the value suggested by previous experimenters of 9.6 d, the figure given by Prof. W. K. Hatt, of Purdue University, in a paper in the 1909 "Proceedings" of the Indiana Engineering Society.

For nails driven parallel with the grain of the wood the figures above should be reduced 25%. All of these values should be reduced if the penetration of the nail in the holding piece is less than 50% of its length.

Other conclusions in the report are that the resistance of nails driven perpendicularly in the timber with the grain of the wood parallel to the load is but little more than for nails driven similarly with the grain of the wood perpendicular to the load. It is also indicated that the standard nail heads are of proper proportions, there being no difficulty with the nail head pulling through the outside timber. The strength of the joint seems to be affected but little by the penetration of the nail in the centerpiece if that penetration is 40% or more of the length of the nail, but with less penetration the loads were reduced, and for a penetration of 30% the strength reduction amounted to about 25%. The examination showed that each nail in a joint seemed to support an equal proportion of the load.

Two principal factors involved in the strength of nail joints are the resistance of timber to crushing and the nail to bending. This is very graphically shown in the two views of the joint before and after tests. The investigator reports that the resistance of the nailed joint if depending solely on the resistance of the wood to crushing varies with the diameter of the nail, other



NAILED TIMBER JOINTS CUT TO SHOW POSITION OF NAIL BEFORE AND AFTER TEST

things being unchanged. On the other hand, the resistance of the joint if depending solely on the resistance of the nail to bending varies as the cube of the diameter of the nail. As the resistance of the joint depends on the combination of these two, various sized nails give varying degrees of resistance, but it is found that the variation of the resistance corresponds quite closely with the square of the diameter of the nail.

The data for the report were collected by Henry F. Blood, engineer of the bureau of buildings, Portland, Ore., and the report was put into final shape by H. D. Plummer, inspector of buildings of the city.

War's Influence on British Road Work Discussed in Report

Heavy Motor Traffic Has Damaged Highways—Maintenance Deferred—Much Reconstruction After the War

WAR CONDITIONS, as they have affected the construction and maintenance of roads in Great Britain during the year that ended Mar. 31, 1917, are discussed at length in the seventh annual report, just issued, of the British Road Board. Heavy motor traffic, connected directly or indirectly with military operations, has damaged many miles of highway, while maintenance work, urgently needed, has been deferred because of lack of funds and shortage of labor. The Road Board foresees a road reconstruction and repair program on a large scale after the war. Excerpts from its report, as published in *The Surveyor*, follows:

Since the outbreak of war great advantage has been derived from the improvements effected in important roads throughout the country with the assistance of grants and loans from the Road Improvement Fund. But the heavy motor traffic directly or indirectly connected with military movements and the transit of warlike stores has caused a great deal of damage to many miles of road, and, notwithstanding the expenditure of nearly £1,500,000, which represents the cost of special work on public roads paid for out of army funds and other government contributions, an extensive road mileage, used by the special traffic referred to has greatly deteriorated in condition.

Large Expenditures After War

No doubt is entertained by the board that a considerable amount of expenditure will have to be incurred on these roads after the war. Many other roads have also suffered damage by the substitution of motor traffic for horse-drawn traffic in connection with agricultural operations in some counties. Concurrently with these things, the expenditure of highway authorities on maintenance has been reduced, partly for financial reasons and partly owing to shortage of labor and materials. There will therefore be a considerable leeway to be made up after the war before roads can be restored to their pre-war condition.

Meanwhile, the policy of the board in regard to making grants and loans has been continued on the lines laid down by the treasury. During the current year the board is distributing, with treasury sanction, a sum of £200,000 out of the Road Improvement Fund, mainly in the form of assistance to expenditure on tar treatment of main county roads in Great Britain which are in a suitable condition for tar treatment, and in doing so they are endeavoring to secure that sections of road which were improved with the aid of Road Board grants prior to the war shall be preserved, as far as possible, in a condition which will prevent the benefit of improvements already made being lost.

Apart from the question of deferred maintenance expenditure and special damage caused to roads by heavy motor traffic in connection with the war the question of expenditure required in the near future for the improvement of roads has been considered by the board, and its views on this matter are set forth in a letter addressed to the secretary of the reconstruction committee.

In this communication the board states that the works of road construction and improvement which are required, and, if funds were forthcoming, might be available for execution after the war, may be divided into four classes:

(1) Works of (*a*) strengthening and resurfacing, and (*b*) drainage reconstruction, and resurfacing, which are of first importance, and should be proceeded with as soon as finance, labor, and materials can be provided.

(2) Works of road widening and new construction which have been approved, but the execution of which was postponed owing to the war, on financial considerations.

(3) Reconstruction of bridges on important roads which are unable to support heavy motor traffic, including bridges owned by railway and canal companies.

(4) Schemes for the construction of new roads and bridges, widenings in urban areas involving the purchase of buildings, and widenings and improvements of important country roads involving the purchase of property. These schemes represent desirable improvements, but their value in relation to their cost can be determined only by investigation and consideration of each scheme by the local authorities concerned in conjunction with the Road Board.

Reconstruction

The most urgent need at the present time, the board continues, is the reconstruction of important roads which are too weak to carry modern traffic. The urgency of this reconstruction is twofold—(1) To provide for the traffic of heavy motor vehicles which is expected to expand rapidly after the conclusion of the war, and if not provided for in advance will cause serious deterioration of roads and consequential damage and expenditure; and (2) experience has shown that it is less costly to highway authorities, in the long run, to construct roads of a type suitable for the traffic, rather than to continue the use of methods and materials which have become antiquated.

Conditions in England and Wales

The total mileage of roads in England and Wales is 152,000. It may be assumed that 10 per cent. of the total, or about 15,000 miles, stands in need, more or less urgent, of reconstruction or strengthening, as distinguished from resurfacing in the course of ordinary maintenance, in order to enable the roads to carry the growing motor traffic. The cost of reconstruction may be estimated at from £1000 to £4000 per mile, or at an average of £2000 per mile. The total cost of dealing with 15,000 miles may be estimated therefore at approximately £30,000,000 over and above the normal expenditure of the local authorities on current and deferred maintenance.

The annual expenditure of highway authorities in England and Wales on maintenance and improvements, including loan charges, is about £16,000,000. This sum is provided out of the local rates, with some assistance from the Exchequer Contribution Account. For prac-

tical purposes, £16,000,000 may be regarded as the maximum which highway authorities will spend on road services under existing conditions. There is no practical prospect of these authorities providing, without express statutory direction or considerable financial assistance from central funds, the capital sum which is necessary to reconstruct the more important roads of the country, even though the expenditure of that capital should be shown, not only to effect large savings in the wear and tear of vehicles, but also to arrest the increase in annual maintenance expenditure, which has been growing at a very serious rate, and which is certain, unless large capital expenditure is incurred, to continue to grow, if deterioration of roads is to be prevented.

Road Improvement Fund

Apart from the local rates and imperial subventions, the only public revenue available for road purposes is the Road Improvement Fund. The income of this fund, for the financial year ended Mar. 31, 1915, was £1,621,000. Of this sum, £898,000 was the proceeds of the motor spirit duties, £630,500 arose from carriage licenses and £92,500 from interest on investments. The revenue from the motor spirit duties and carriage licenses has since August, 1916, been diverted from the Road Improvement Fund to the exchequer. The proceeds of the motor spirit duties were the result of a tax of 1½d. per gal, on petrol used in commercial and public service vehicles. Since that date the duties and license charges on petrol used in private cars have been increased to 1s. per gal. and in commercial and public service vehicles to 3d. per gal. The proceeds of these increased duties are not known to the Road Board.

The restoration of the proceeds of the duties, either on the old or an enlarged scale, to the Road Improvement Fund would enable the Road Board to make some contribution to the £30,000,000 required, but such contribution would represent but a small proportion of the total.

Classification of Roads

In this connection it may be mentioned that shortly before the outbreak of war proposals were under consideration by the government for the classification of the roads and a revision of the exchequer grants to local authorities in respect of their expenditure on various semi-national services, including roads. The Road Board, at the request of the Local Government Board, had undertaken to classify the roads in England and Wales, as such classification was an essential preliminary not only to a sound scheme of State aid, but also to any general scheme of reconstruction. The classification was nearing completion on the outbreak of war, when the work was suspended. It will be practicable, however, to continue the work from the point at which it was broken off as soon as the board receives authority to proceed.

Although, as a class, all such works as new roads, widenings, etc., are of secondary importance, as compared with the reconstruction of the road crusts of important roads, there are some which are of considerable value, and should be carried out side by side with road crust improvements. Applications in respect of such works have been received by the board, and a number have been approved by them as suitable for assistance from the Road Improvement Fund and as works which may be carried out as soon as circumstances permit, the total estimated cost in England and Wales being £1,314,152. It must be understood, however, that this includes only such works as have been made the subject of an application to the board.

There are similar works which would be deserving of assistance as soon as the urgent works of reconstruction are completed or funds are available. The cost of works in this class which may have to be taken in hand at some time or other would probably not be less than £5,000,000.

Bridges

There are a very large number of bridges in all parts of the country which require reconstruction. The Middlesex highway authorities, for example, have made an application to the Road Board for grants toward the reconstruction or widening of twenty-two bridges, the cost of which is estimated by the councils at upward of £150,000. In every county there are a large number of bridges vested in highway authorities or owned by railway and canal companies which are scheduled as capable of carrying vehicles of only a limited tonnage, with the result that a very large mileage of roads—often important roads—are closed to traction-engine and heavy motor-car traffic, until such time as these bridges can be reconstructed.

A recent decision of the House of Lords will have the practical effect of throwing, in most cases, upon highway authorities the cost of the reconstruction of weak bridges carrying public roads over railways and canals. It may be roughly estimated that the expenditure necessary to reconstruct bridges on important roads so as to support the motor traffic legalized by Parliament will not be less than £7,000,000. This is a very conservative estimate.

Suggestions have been put forward from time to time for schemes for the construction of new roads and various improvements, but the consideration of which has not been entered upon in detail in the absence of any prospect of financing them while the more urgent work of road-crust improvement was in progress. These schemes may be grouped into the following classes:

(*a*) New approach roads to large towns.
(*b*) New bridges giving additional communication.
(*c*) New roads to connect county boroughs.
(*d*) New by-pass roads to avoid narrow villages.
(*e*) Improved communications and widenings in urban areas, involving high cost due to the purchase of buildings.
(*f*) Improvement and reconstruction of important through routes, involving the purchase of property and costly work.

These and similar schemes, the aggregate cost of which would amount to many millions, have not been examined or estimated in detail by the Road Board in conjunction with the local authorities, nor has the relative public value and cost been appraised, a work which would involve a large expenditure of time and money, for the reasons already mentioned. It may be assumed that, in almost every case, the local authorities affected

would not be prepared to accept financial responsibility for schemes of the character under discussion, and that their contributions toward them, except in the case of some urban widenings of only local importance, would represent but a very small fraction of the cost. For this reason very few of such schemes can be regarded as being within the range of practical consideration at the present time, especially while the really urgent work of road-crust improvement remains to be undertaken when funds are available.

Of a somewhat similar nature are the proposals of the recent Metropolitan Arterial Road Conferences for the construction of about 130 miles of approach roads to London, 70 miles being entirely new. The Local Government Board has requested the Road Board to examine these schemes, which, taken altogether, if their execution were proceeded with continuously, might involve an expenditure by all parties concerned of considerably over £10,000,000, and it might approach £15,000,000. The highway authorities concerned have made it clear that they are not prepared to provide any considerable proportion of the expenditure. No possible source of revenue is, therefore, in sight. The proportion of the Road Improvement Fund, as now existing, which the board can regard as available for grants toward road improvement schemes in Greater London, with the exception of a few thousand pounds, have already been pledged to works in progress, but most of which have been held up during the war. The board has pointed out to the Local Government Board that its examination of the schemes cannot be of a very practical character if it is conducted on the assumption that no money assistance is likely to be forthcoming beyond any possible grants from the Road Improvement Fund.

Scotland and Ireland

As regards Scotland, the mileage of roads requiring reconstruction and strengthening over and above the mileage that can be dealt with by the local authorities themselves out of their own resources may be taken at about 2000 miles, at an average expenditure of £1500 per mile, or a total of £3,000,000.

No estimate can be given as regards Ireland, but it may be mentioned that the special circumstances which have caused the great increase in road expenditure in England and Wales, and in some parts of Scotland, due to the large volume of motor traffic, have not hitherto pressed with any severity upon the highway authorities in Ireland.

The board has continued the special work which it undertook after the outbreak of war at the request of the Army Council, namely: (1) To supervise and arrange for the construction and maintenance of new roads, and the improvement of certain private roads in several districts for military purposes in connection with camps and otherwise, and to carry out such work, where required, by direct labor; (2) to arrange with highway authorities for improvements, mainly at the cost of the Army Council, on public roads required for military purposes, and to supervise, or to carry out by direct labor, the execution of the improvements; (3) to settle by negotiation with highway authorities the amounts payable by the Army Council in respect of damage caused by extraordinary traffic in connection with military purposes. Similar work has, with treasury approval, been undertaken for the Admiralty, Ministry of Munitions, and Timber Supply Department of the Board of Trade.

Boston Society Reports on Civil Service Engineers

A SPECIAL committee appointed by the Boston Society of Civil Engineers has been investigating for the past year the question of the classification of civil engineers in the civil service of the State of Massachusetts, with a view to suggesting such qualifications and changes as would improve the appointment and employment conditions in that service. The committee reported to the society under date of Sept. 13. It made a number of recommendations, the most important of which are noted here.

The committee recommended such modifications of the civil service rules and regulations as may be necessary to conform to a new classification, as follows: Grade A, rodmen up to $900, inclusive; grade B, rodmen whose pay is over $900 and not exceeding $1400; grade C, junior assistant engineers with pay over $1400 and not exceeding $1900; grade D, senior assistant engineers with pay over $1900; grade E, junior draftsmen with pay up to $900 inclusive, and grade F, senior draftsmen with pay over $900 and not exceeding $1600. The qualifications for these grades are as follows: Grades A and E, one year's good practical experience or the successful completion of one year's study in a school of engineering of recognized standing; Grades B and F, three years' experience or graduation plus one year's experience, or two years' study at an engineering school plus two years' experience; Grade C, five years' experience or graduation plus two years' experience; Grade D, eight years' experience or graduation plus four years' experience.

The committee places great stress on the necessity for ascertaining a candidate's experience, and says an experience sheet should be filled out in minute detail, especially in the cases of applicants for examination for higher positions. In all cases this sheet should be in such form as to determine an applicant's experience as fully as possible. The Civil Service Commission should investigate this experience and verify the tabulation, besides getting further information as to a man's ability, character, habits, and personality. To do this the committee realizes that the commission will have to have a larger force than it now has available.

The committee considers further that it is undesirable to lay so much stress as at present on the written examination. Especially for the higher grades of work, the experience of the applicant plus an oral examination should govern. It recommends, for instance, that the weight assigned to the experience and to written examinations should be changed from the present standard to one giving more weight to the experience; for the senior assistant engineer, for instance, from a weight of 28 to experience and 72 to written examination, to 80 to experience and 20 to written examination. While realizing that it is impossible to do away entirely with the written examination, the committee recommends that it be reduced as much as possible.

Twenty-Four Designs for Salem Bridge Wasted Before Commissioners Agreed

Contract Let After Three Years' Wrangling of Public Officials—Twenty-Five Designs Prepared—Prize Competition, but Prize Not Awarded—Public Loses by Delay Because of Rising Prices

EDITORIAL CORRESPONDENCE

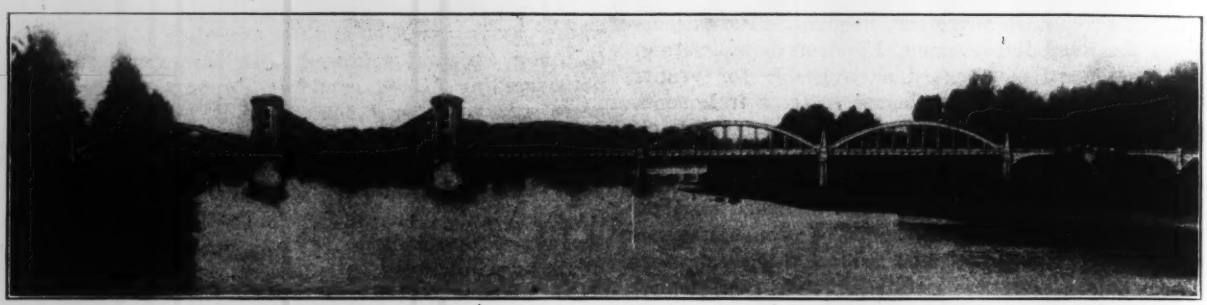
THE AWARD of the contract for the bridge across the Willamette River at Salem, Ore., brings to a close three years of indecision and controversy. While the principal loser in the whole affair is the taxpayer, the engineering profession is also involved. Engineering advice and engineering services were sought, particularly when they could be obtained without charge; but when given they met with scant consideration and discourteous treatment by public officials.

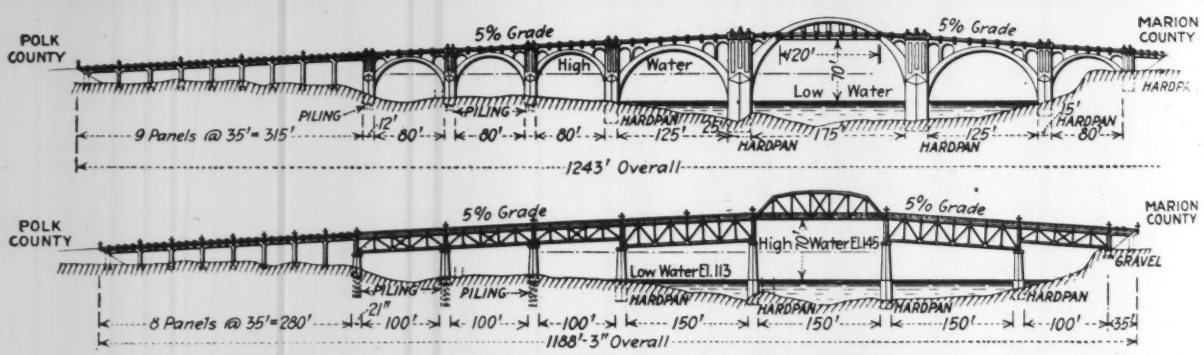
The Willamette River at Salem forms the boundary between Polk and Marion, two of the most important and wealthy counties of Oregon. Salem, in Marion County, is adjacent to the river bank, while a populous farming section adjoins the opposite side of the stream. The existing predecessor of the new Salem bridge is a typical product of the contracting bridge companies—what has been called in Kansas a "tin" bridge. While its age is much less than the ordinary life of a steel bridge, its $\frac{1}{4}$-in. and $\frac{3}{16}$-in. gusset plates, its light channels, inadequate lacing and flimsy connections, needing paint to hide their nakedness, have seriously deteriorated. The old bridge has been frequently examined and as often condemned by engineers of the Oregon State Highway Department. This engineering condemnation was, hardly necessary, however, as the corrosion and the deflection and vibration of the structure betrayed its condition even to the layman's casual observation, and created public fear.

Legal difficulties in the early efforts to obtain a new bridge could have been adjusted easily, and with the bridge forming a link of a heavily traveled trunk road between counties financially able to construct a new bridge, there existed pretext but not reason for the delay in beginning an entirely adequate structure.

The first design for the Salem bridge was prepared in 1914 by the State Highway Department. While the state contributed no portion of the cost of the bridge, it was interested in having a suitable structure built upon an important road, and took this means of encouraging construction. A year later, in 1915, with a changed administration in the department that had different notions as to the best type of structure, two more sets of plans were prepared. All of these plans were furnished to the county commissioners, the interested authorities in both counties, but no definite action was taken upon them.

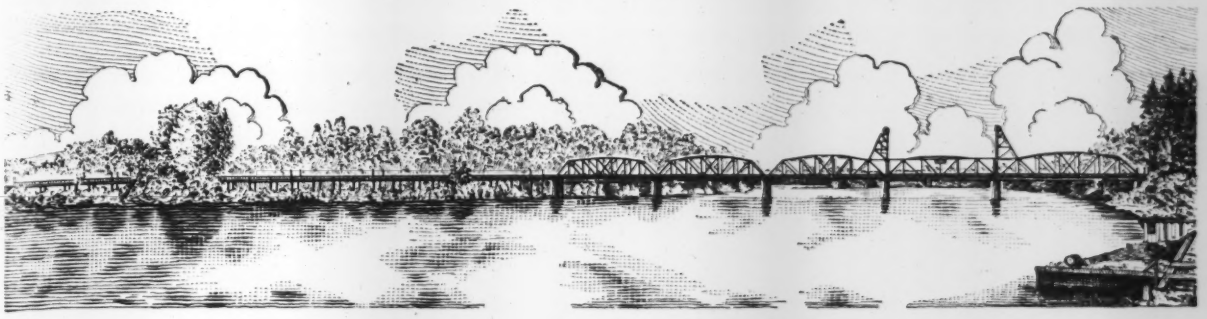
In December, 1915, by joint authority of Polk and Marion Counties, a prize competition was instituted, and a prize of $1000 was offered for the best plan, under certain loadings and conditions. The offer was widely





THREE DESIGNS FOR THE SALEM BRIDGE PREPARED IN 1915

Upper sketch, No. 2 of table, by H. W. Holmes, of State Highway Department. Middle and lower sketches, Nos. 6 and 7 of table, by Baar & Cunningham, Portland



ONE OF THE 1916 DESIGNS FOR THE SALEM BRIDGE
No. 23 of table, by Joseph Weare, of State Highway Department

advertised. As it was apparently made in good faith, and the award of the prize by implication would give to the successful competitor also the commission for preparing detailed plans and superintending construction, engineering firms in the Northwest and elsewhere prepared designs. At the opening of plans Dec. 24, 1915, ten engineers were represented, with nineteen sets of plans of diverse types and styles.

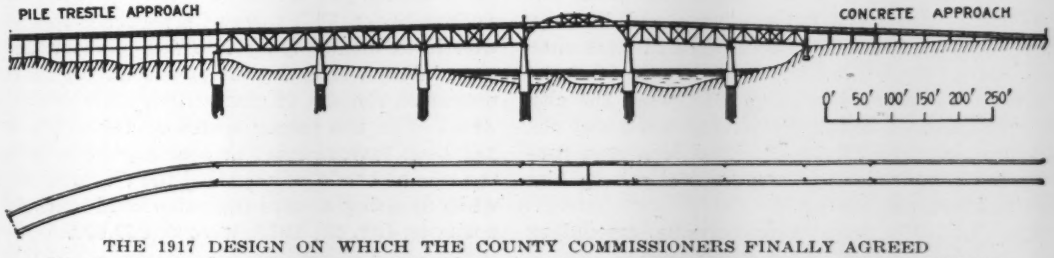
Choice of the best plan was to be made by a board of three "viewers" designated by the Marion County commissioners, with the assistance of the bridge department of the State Highway Commission. After several days of deliberation, choice was narrowed down to three designs, those of Baar & Cunningham, of Portland, Ore.; Charles Huber, of Seattle, Wash., and C. E. Fowler, also of Seattle. Beyond this point no further decision was made by the viewers. To the date of writing, no decision or award of the stipulated prize has been made, and the contestants have not been notified or communicated with in any way by those in authority. Although the nineteen sets of plans submitted represent in aggregate cost and in engineering skill a value considerably higher than the $1000 offered as a prize, the contestants have not received even the courtesy of the return of their plans with a valid and legal reason for rejection.

About a month after the competitive plans were received a new tack was taken. Marion County formally requested the State Highway Commission to prepare a set of plans. In making this request the authorities expressed their preference for a low-level steel-truss bridge with a direct-lift draw. The State Highway Department had by this time come again under a new administration, with John H. Lewis, state engineer, acting as highway engineer. Knowing the past record of delay and temporizing, Mr. Lewis refused at first to mix in the bridge matter, but later, finding that he was required by law to prepare such plans upon request, he authorized his department to go ahead with the work. Since the instructions were definite as to the preferred type of bridge, it was assumed that this design would be final, and it was worked out in considerable detail, at a cost to the state of about $1800.

Before the state plans were entirely complete, a new controversy developed. Polk County decreed that it would accept none but a concrete bridge. Marion County insisted upon having a steel structure. Polk County refused to consider the latest plan of the State Highway Department, and employed a firm of Portland engineers who agreed to design a concrete bridge upon a contingent fee basis, the plans to be paid for if the bridge was built. The deadlock betwen the adjoining counties over the type of bridge, concrete or steel, combined with an additional controversy over the exact site, resulted in a muddle which continued over the remainder of the year 1916 and effectually prevented any progress.

Early in 1917 the commissioners of Polk and Marion Counties, impelled by the increasingly dangerous condition of the old bridge and by public clamor for action, got together in a degree by making a joint request of Mr. Lewis that his department make an investigation, report upon the best site and recommend the style of bridge which should be built. Studies were accordingly made by Joseph Weare, state bridge engineer. Not being limited as previously by any instructions as to type, he recommended a type differing from that already designed—a high-level steel-truss bridge, eliminating the drawspan.

In the spring of 1917 the two counties were finally able to reconcile their differences. The high-level design of the State Highway Department was adopted, detailed plans were prepared and in July, 1917, a contract was awarded to the Coast Bridge Co., of Portland, Ore., for $237,901. Construction is now being



THE 1917 DESIGN ON WHICH THE COUNTY COMMISSIONERS FINALLY AGREED
No. 25 of table, by Joseph Weare, of State Highway Department. Contract let in July, 1917, for $237,310

CHARACTERISTICS OF TWENTY-FOUR REJECTED DESIGNS AND THE CONTRACT DESIGN FOR THE SALEM BRIDGE

Number	Date	Engineer	Type	Estimated Cost
1	1914	State Hwy. Dept. (C. H. Purcell, bridge engineer)	Low-level; steel trusses, swing draw-span, concrete approach	Not available
2	1915	State Hwy. Dept. (H. W. Holmes, bridge engineer)	Low-level; concrete arches, suspended floor, bascule draw	$235,000
3	1915	State Hwy. Dept. (H. W. Holmes, bridge engineer) (alternate plan)	Low-level; steel trusses, bascule draw-span	190,000
4	Dec., 1915	Bowerman & McCloy, Seattle	Low-level; concrete arch bridge	232,000
5	Dec., 1915	Baar & Cunnginham, Portland	Low-level; steel trusses, concrete approach, direct-lift draw	158,112
6	Dec., 1915	Baar & Cunningham, Portland (alternate plan)	High-level; concrete arch bridge, concrete approach	218,260
7	Dec., 1915	Baar & Cunningham, Portland (alternate plan)	High-level; steel trusses, concrete approaches	126,430
8	Dec., 1915	W. H. Cullers, Portland	Low-level; steel trusses, swing draw-span, no approach shown	192,430
9	Dec., 1915	Chas. Evan Fowler, Seattle	Low-level; concrete arches, concrete approach	233,200
10	Dec., 1915	Chas. Evan Fowler, Seattle (alternate plan)	Same design with wooden approach	203,200
11	Dec., 1915	Chas. Evan Fowler, Seattle (alternate plan)	Low-level; steel arch spans, concrete approach	230,986
12	Dec., 1915	Chas. Evan Fowler, Seattle (alternate plan)	Same design with wooden approach	200,986
13	Dec., 1915	Chas. Evan Fowler, Seattle (alternate plan)	Low-level; steel bridge (24-ft. roadway), concrete approach	192,107
14	Dec., 1915	Chas. Evan Fowler, Seattle (alternate plan)	Same design with wooden approach	175,107
15	Dec., 1915	Chas. Evan Fowler, Seattle (alternate plan)	High-level; steel trusses, plank floor, wooden approach	148,180
16	Dec., 1915	Chas. G. Huber, Seattle	Low-level; concrete arches, Strauss bascule	294,510
17	Dec., 1915	Chas. G. Huber, Seattle (alternate plan)	Low-level; steel trusses, Strauss bascule	246,700
18	Dec., 1915	A. H. Lamm, Portland	Low-level; concrete arches, concrete approach, draw not included	171,390
19	Dec., 1915	Marsh Eng. Co., Des Moines, Ia.	Low-level; concrete arches	Not furnished
20	Dec., 1915	Portland Bridge & Bldg. Co.	Low-level; steel trusses	190,102
21	Dec., 1915	Scherzer Rolling Lift Bridge Co.	Steel truss bridge with rolling-lift bascule	191,153
22	Dec., 1915	Robt. Wakefield, Portland	Low-level; concrete arches	195,000
23	1916	State Hwy. Dept. (Jos. Weare, bridge engineer)	Low-level; steel trusses, concrete approach, direct-lift draw	198,500
24	1916	Clark & Purcell, Portland	High-level; concrete arches, concrete approach	Not available
25	1917	State Hwy. Dept. (Jos. Weare, bridge engineer)	High-level; steel trusses, wooden approaches	237,901

carried out under the supervision of C. H. Purcell, state bridge engineer.

A great loss of public money had resulted from the delay during a rising market. In 1914 and 1915, when the first designs were made, prices had begun to advance, yet the estimated cost of a high-level bridge such as was finally approved was only $126,430 in 1915, as against the 1917 contract price of $237,910. Estimates for concrete arch structures in 1915 were no higher than the cost of a steel bridge in 1917. While it may be argued that present prices of materials and labor could not be foreseen, it must be admitted that during the whole period from 1914 to 1917 contract work showed continuous advances in cost, and it was generally recognized that delay in executing proposed plans would be expensive.

But the most remarkable and deplorable feature of the case is the manner in which public officials, county commissioners, played battledore and shuttlecock with engineers and engineering services. The part played by the various state highway departments of the country in taking the legitimate commissions of private engineers has often been criticized. More subject to condemnation is a situation in which a state department is required by law to prepare expensive engineering plans, and where such plans, after superficial consideration by petty officials, are consigned to the waste basket, new plans ordered and the whole process repeated to a nonsensical limit. The Oregon Highway Department, through a succession of administrations, prepared five distinct sets of plans for the Salem bridge.

The most righteous cause for complaint, from the engineer's viewpoint, is the treatment accorded to the participants in the so-called prize contest. If there had been action in good faith and within ethical limits, it is safe to say that any firm winning the $1000 prize and the commission for subsequent work would have received the congratulations and good wishes of the other contestants. That none of the nineteen competing designs was suitable is not believable; in fact, the plan finally used resembles very closely one of those entered in the contest. The failure without color of reason to make any award whatever is unfair to all the contestants in equal measure, if not actually illegal.

Municipal Savings Bank at St. Paul Finances Local Improvements

ST. PAUL has a financial institution which is somewhat original. In a way, it is a municipal savings bank, and its purpose is to finance local improvement work. Shares of city bonds are sold to the people in $10 denominations. The city pays 4% interest on these deposits and pays it to the date when withdrawal is made, so that the holder receives interest for every day he holds the shares. One clerk in the city treasurer's office, at a salary of $1800, runs this bank. Interest payments are made twice a year and in July, 1917, amounted to $47,758. There were at that time 3086 depositors.

The system was started in July, 1913, when the city wanted to dispose of bonds for paving work and the bond buyers appeared "finicky." The idea was conceived by the comptroller and was worked out by him and the city treasurer.

On Apr. 1, 1916, there were deposits amounting to a little less than $2,000,000 when a run, due to a grand jury attack, was started on the bank. A committee headed by a local banker asserted that the bank was unsafe and illegal. The run continued until May 2, 1916, when it stopped with $1,040,000 remaining in the bank. Every depositor who presented his certificate received his cash with interest at once. Citizens then demanded an amendment making this municipal bank a part of the city's financial system and this charter amendment was adopted at the next election.

The larger part of the deposits is from stockings and other hiding places and is money never handled by a savings bank. This form of investment appeals to those who have money lying idle for a short time, for it pays interest on a deposit of one day or more. It has proved an element of competition with the bond buyers who bid in the larger issues of the city's bonds and has been instrumental in securing large premiums in the sale of bonds or has tided the city over tight places while awaiting a more favorable bond market. The deposits on Oct. 27, 1917, were $2,569,000.

Frozen Concrete in Floor Slab Has Low Tested Strength

Piece Cut from Slab Shows Upper Half with Frost Marks and Low Strength While Lower Half Is Normal

BY SANFORD E. THOMPSON
Consulting Engineer, Boston

EXPERIENCE has taught that freezing concrete reduces its strength, but there are not many tests of actual structures in which such reduction has been measured. A recent case in the writer's practice involved an investigation of the effect of frost action on a flat-slab concrete building floor, and the specification of the necessary repairs. The case differs from most of those discussed in technical literature in that no failure resulted, only a small area on an upper floor being affected.

In the fall of 1916 the concrete of the slab in question was caught by frost during an unexpected drop in temperature. It remained frozen during the winter but was subjected to more or less thawing and freezing.

Examination of the concrete early in March showed that it still contained moisture and was so soft as to be crumbled readily by the fingers. This condition occurs frequently with concrete subjected to cold weather, sometimes when it is not actually frozen; but usually such concrete hardens satisfactorily with time or with the aid of artificial heat. A preliminary examination indicated that this ultimate hardening might occur and the use of artificial heat was advised.

In the latter part of March further examination of the slab and of samples under laboratory treatment showed that while the concrete, by the heat treatment, had attained considerably greater strength than formerly, it was not satisfactory yet and could not be depended upon to attain in the future the strength required by standard design. Consequently, computations were made and specifications prepared for thickening the granolithic finish, bonding it to the base concrete and reinforcing with steel over the column head.

The tests and examination of the concrete showed that the strength of the upper part of the slab was reduced by crystallization of water in freezing, as shown by frost marks in the interior of the concrete but that the bottom portion of the same slab, which probably retained less water and was slightly protected by forms, was of satisfactory strength and showed no crystallization. Additional reinforcement was needed therefore in the upper portion to make up for the loss of strength.

The recommendations for strengthening were made partly as a result of tests and partly from the appearance of the interior of the concrete.

To test the concrete, it was found impossible to cut a piece out from the top, as is frequently done, because the concrete was not hard enough. Therefore a small section was cut out clear through the slab. The top was found to be much softer than the bottom; in fact, the lower 6 in. were markedly harder than the upper 4 in. Since a slab is subjected to transverse fiber stress, the top and bottom portions act separately and for this reason the sample was sawed in two equal parts horizontally and each half was tested separately.

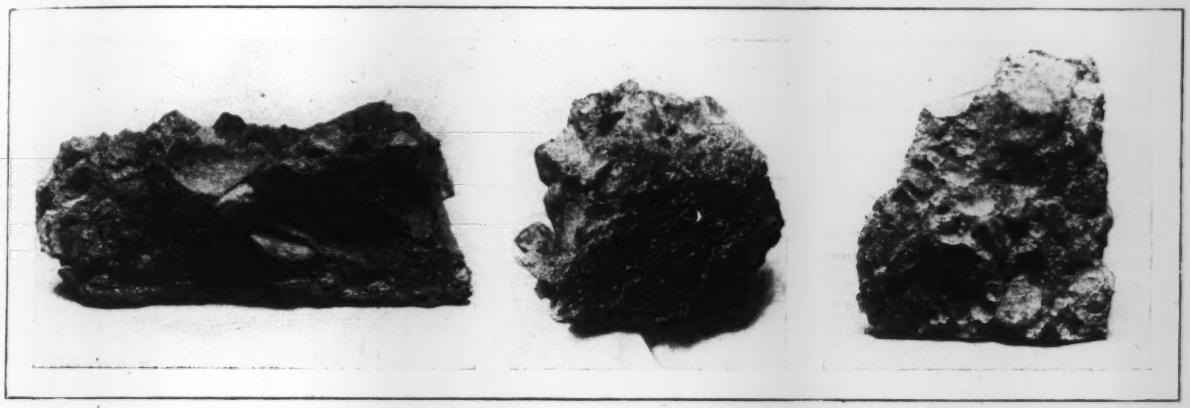


FIG. 1. FROST MARKS SHOW ON CONCRETE FROM INTERIOR OF SLAB

FIG. 2. SURFACE OF SLAB IN FOREGROUND

FIG. 3. SOLID CONCRETE AT BOTTOM OF SLAB

The results of the test, corrected in order to base them on specimens having a height of twice the least width, showed that the crushing strength of the lower part of slab was 1900 lb. per sq.in. and of the upper part, 890 lb. per square inch.

Most interesting, also, are the photographs, which indicate the cause of the low strength. Fig. 1 shows the interior of the concrete, with frost marks on all the surfaces in contact with stone. Evidently the adhesion is greatly reduced. This reduction in adhesion is further shown by the looseness of many of the stones. In fact, the photograph itself shows actual cracks around several of the stones. Fig. 2, looking down on the surface of the slab, shows the surface marks caused by water freezing on the top; also at the left of the photograph and at the top are shown portions of the interior with the same frost marks as in the preceding figures. Fig. 3 is the interior of the bottom portion of the slab, which shows higher strength. It will be seen that the frost marks are absent.

The results indicated that the limit of strength of the concrete, especially of the upper part, probably had been reached, and since concrete designs are based on a stress of 2000 lb. per square inch for 1:2:4 concrete, certain parts of the slab had only one-half the strength required by the design.

In specifying repairs the bottom of the slab at the center, made of a good grade of concrete and reinforced with steel, was considered satisfactory, especially as it was still growing in strength. The compressive strength of the upper part of the slab at the center was increased by applying a well bonded layer of granolithic. At the support the bottom of the slab was considered satisfactory. The top of the slab, however, was composed of poor concrete. In a flat slab, concrete in the top of the slab over the support is of actual value in assisting the steel to take the tensile stress; furthermore, a low compressive strength indicates a low bond strength, so that in this case the strength of the steel in bond is reduced nearly one-half. To make up for this poor concrete, reinforcement was laid in the granolithic placed on the slab over the support.

Salem (Ohio) Sewage Works Show Evils of Carelessness and Neglect

POOR FILTER material, inadequate capacity and negligent operation have resulted in bad effluent from the sewage works of Salem, Ohio, and some fifteen damage suits have been brought by riparian owners below the works.

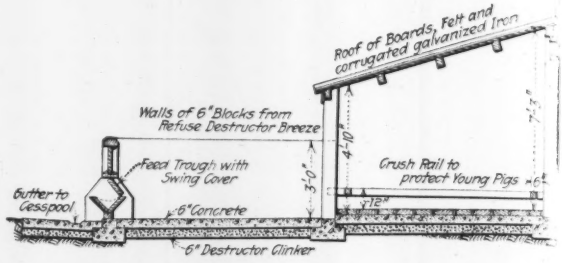
The plant was completed in 1913 under orders from the State Board of Health, requiring the city to eliminate the pollution of First Culvert Creek, a small stream which runs virtually dry in summer. The plant was designed to treat 1,000,000 gal. of sewage daily. The population at the time the plant was put in use was about 9500. Funds being limited, it was impossible to build a plant large enough to take care of future growth. Recent inspection of the plant has shown that it is greatly overtaxed, the sewage flow at times being 3,000,000 gal. a day. The city now has fifteen miles of sewers, a large part of which, constructed on the combined plan, has been in use many years. Large volumes of storm water reach the sewers and overtax the work greatly. Failure to exclude the storm water or provide otherwise against overworking has contributed largely to the failure of the plant.

One of the conditions of approval of the plans by the State Board of Health provided that samples of sand for the filter beds should be submitted to the board for approval before the material was placed. Considerable difficulty was encountered in obtaining sand of satisfactory quality at a cost which was not prohibitive. After careful inspection the board approved the use of bank sand and gave specific instructions regarding the removal of the material from the bank. Subsequent inspection of the filters showed that these instructions had not been followed, as the beds were found to contain a considerable amount of loam, making it impossible to operate them at the rates for which they were designed. To add to the difficulty, the operation of the works was neglected by the city. This neglect, combined with the poor filter material and the overworking of the plant, has made it impossible to produce an effluent which does not cause a nuisance.

The city has retained the W. J. Sherman Co., of Toledo, Ohio, to make an investigation of the condition of the sewage-works and recommend such changes as may be needed.

British Cities Build Municipal Garbage Piggeries

GARBAGE utilization by municipal piggeries and by private owners of pigs is being practised in a number of British towns under the spur of war conservation needs and at the specific request of the Government. In addition, encouragement is being given to householders and others to keep pigs on a small



A BREEDING PEN IS USED TO STOCK THE BOGNOR MUNICIPAL PIGGERY

scale. Early this year an order in council was issued advising sanitary authorities to relax local by-laws relating to pig-keeping, which in many towns have been so strict as to be prohibitive.

The municipal piggeries are located at refuse destructors, sewage farms, workhouses or elsewhere, according to local conditions. Thus far most of the operations reported have been conducted on a small scale. According to a statement by Oswald A. Bridges, surveyor to the Bognor Urban District Council, in an article in the London *Surveyor*, the accepted British practice is to boil the garbage before feeding it to hogs, skim off the grease and pick out the bones, these materials being stored for sale to the Government.

The Bognor council decided to keep 60 pigs to utilize garbage, beginning with a small number of breeding sows. The piggery is located at the refuse destructor. A cross-section of one of the breeding sties is reproduced from the *Surveyor*.

Advance in Prices of Paving Materials

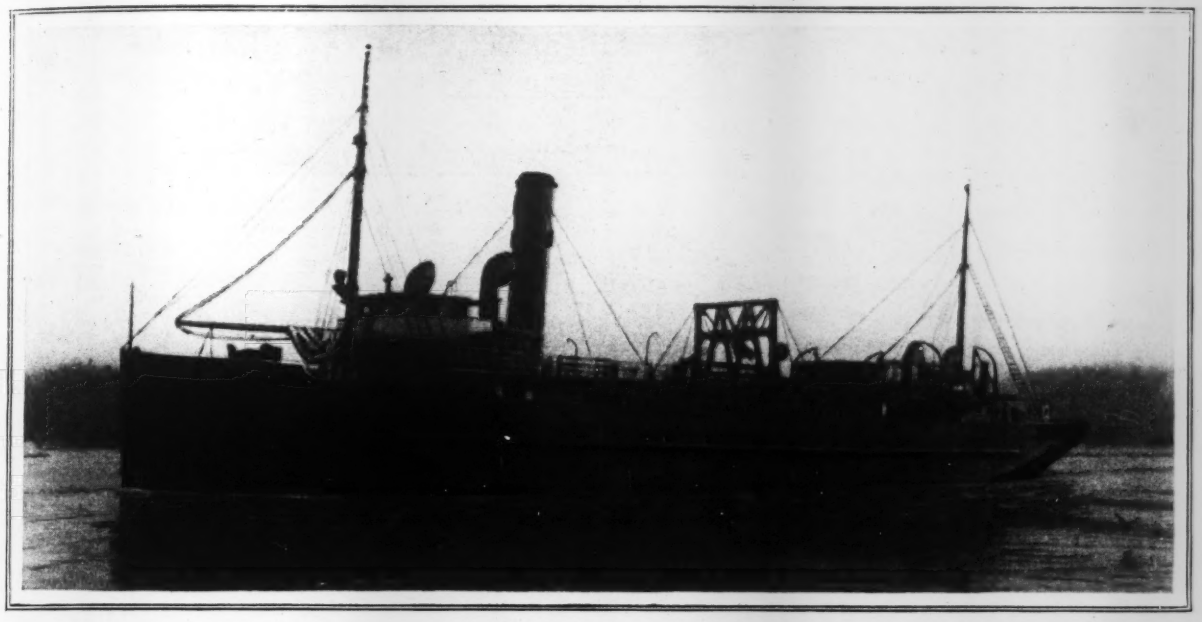
Our attention has been called to errors made in figuring the percentages printed in the table of range of prices of materials (F.O.B.) and labor used in paving Cleveland streets, 1914 to 1917, in *Engineering News-Record* of Aug. 2, p. 207. The corrections will be found in the fifth and seventh columns of figures printed below:

	1914	1915	1916	Mar. 1 1917	Increase from 1914	July 16, 1917	Increase from 1914
City test cement, per bbl	$1.35	$1.65	$1.90	$2.32	72%	$2.80	107%
Crushed stone, per ton	.90-.95 1.00 1.05	1.08	1.13	1.33	48%	1.33	48%
Conglomerate, per ton	.65-.70	.75	.88	.90	38%	1.20	85%
Bank sand, per ton	.55	.65	.70	.75	36%	1.15	109%
Dressed block, Medina per sq.yd.	1.42	1.55	1.65	1.65	16%	1.65	16%
Common brick, per M.	6.75	7.00	7.50	11.00	63%	15.50	130%
Paving brick, 4 in., per M	16.50	16.75	19.50	21.50	30%	24.50	48%
Paving brick, 5 in., per M						29.00	
Teams, per hour	.50	.50	.75	.80	60%	.80	60%
Labor, per hour	17½	22½	.40	.45	157%	.45	157%
Freight increase, per ton	1.50	.....	.....	1.61	7%	1.61	7%

Sea-Going Hydraulic Hopper Dredge for North Pacific Bars

"Col. P. S. Michie," Specially Designed for Heavy Work on Coast of Washington, Oregon and California, Proves Effective and Cheap in Operation

By George E. Tonney
Engineer, Port of Coquille River, Myrtle Point, Ore.



UNITED STATES DREDGE "COL. P. S. MICHIE," ONE OF THE LARGEST AND MOST POWERFUL HOPPER DREDGES AFLOAT

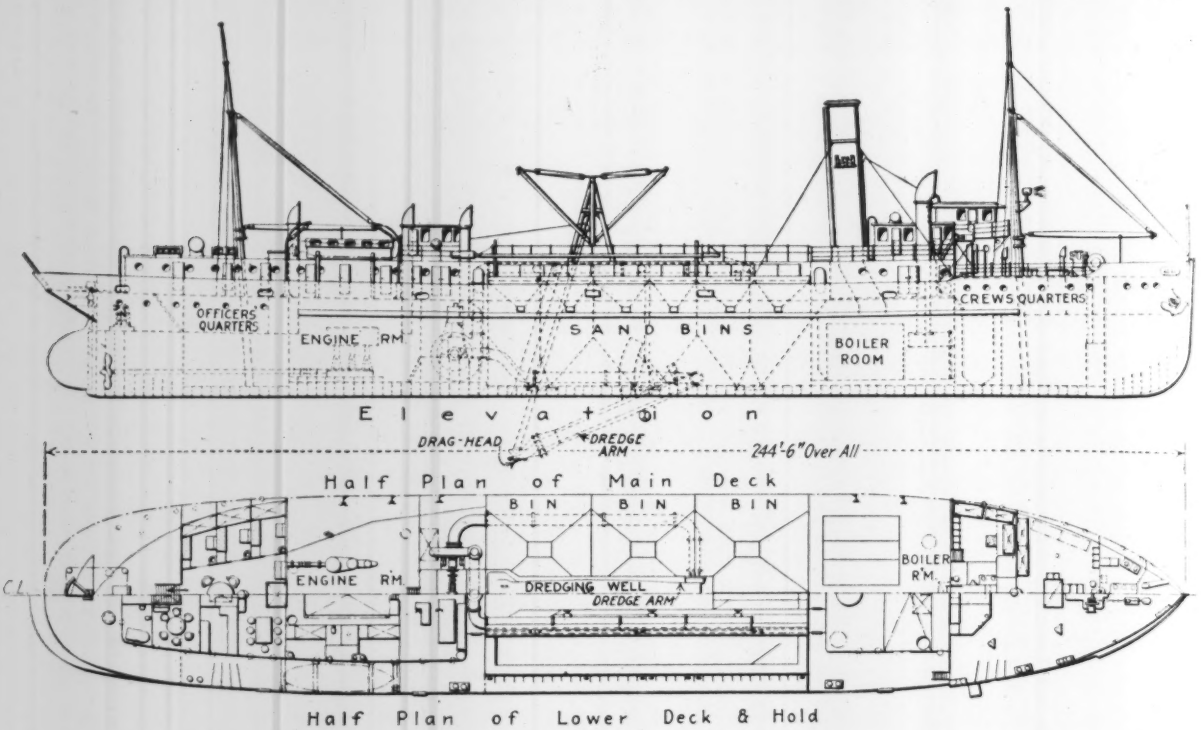
EXTREME conditions of digging and of seaway encountered on the sand bars of the river entrances on the North Pacific, particularly at Coos Bay, Oregon, led some three years ago to the construction by the Federal Government of the seagoing dredge "Col. P. S. Michie," a hydraulic hopper dredge of exceptional seaworthiness and digging capacity. This machine has now been in operation long enough to warrant a description of its design and report of its performance.

The Pacific coast of Washington, Oregon and northern California is difficult of navigation, especially during the winter months, by reason of a regular coast line, unusual depth of water and dense fogs and severe storms. The Columbia River and Coos Bay bars, on which the "Michie" operates, are regarded as among the roughest in the world, and of these the Coos Bay bar is considered the more difficult for hydraulic operations. The bar is narrow, and is exposed to the storms of the open high seas, and to heavy winds, cross currents and tidal waves. The average tide is about 6 ft.

About 9600 ft. of riprap rock jetty was finished in 1894 along the north entrance to the bay. It was subsequently rebuilt at places beaten down by the sea. Some parts of this jetty are now below low water, having been twice rebuilt to a height of 28 ft. above low water. A second jetty for the south entrance and extending into the sea a distance of 4200 ft. was proposed, but never built. This jetty was projected to act as a breakwater for heavy seas, to dispose of cross-currents, control a shifting channel, scour sand deposits and secure a minimum depth of 20 ft. over the bar at mean low water. It is probable that the original intention will be carried out on a more elaborate scale to secure a minimum depth of 30 ft., at a time in the not distant future, when appropriations become available.

The jetty is now of little avail in keeping the channel open. Sedimentary deposits brought down Coos River and other tributary fresh-water streams into the bay have little or no bearing, the formation on the bar of fine sand and silt being the direct action of the waves and tides. The channel made possible by hydraulic dredging has no permanency in either depth or position, and it is essential that dredging operations be carried on at all times to secure and maintain a channel of established dimensions. For these operations the "Michie" was built.

The "Col. P. S. Michie" was designed in the office of the chief of engineers and placed in commission in the spring of 1914. She was constructed in the yards of the Seattle Construction and Dry Dock Co. and delivered ready for service in 16 months from date of award of contract, at a cost of $378,198. The dredge is of steel construction, has a length of 244.6 ft. over-all, molded amidship width of 20 ft.; draft, light, of 11 ft., draft, loaded, of 17 ft.; displacement, light, of 1708 tons and displacement, loaded, of 3372 tons. Her speed, light, is 10 knots and loaded 8 knots, and the speed maintained while in operation is 1½ knots.



SEA-GOING HYDRAULIC HOPPER DREDGE "MICHIE" IS 245 FEET LONG, OF 17-FOOT DRAFT, AND HAS ENGINES OF 1780 HORSEPOWER

The boat is equipped with two inverted direct-acting compound propelling engines for twin-screw propulsion. The engines were built by the Marine Iron Works of Chicago for a working pressure of 224 lb. The cylinders are 16 x 32-in. by 24-in. stroke. The steam generating set consists of two Ballin water-tube boilers having a heating surface of 9000 sq.ft. of surface in both boilers. The fuel consumption is about 8½ bbl. of fuel oil per hour while dredging. The pumping and propelling engines develop about 1780 hp. Contrary to the general rule of marine construction, the boilers are located in the forward part of the vessel, a disposition made necessary by the location amidships of the dredging well and dredging bins. Adjacent to the boiler room is the fuel compartment holding 1100 bbl. of fuel oil.

The "Michie" is a trim vessel of pleasing appearance, with four separate dining rooms and four sets of comfortable quarters, baths and sanitary lavatories, pressure system supplying hot and cold water, and two sets of electric-lighting systems. The crew consists of 35 men, but ample space has been provided for a double crew.

The open center well, commonly known as the dredging well, is located amidships and has a length of 48 ft. and a width of 7 ft. The dredge was designed with hoppers amidships in order that the weight of the material should be carried at the place of greatest buoyance and in order that the fore and aft bulkheads and hopper sides would contribute materially to the strength of the structure. In this well operates the dredge arm, one end of which is connected rigidly to the vessel by means of heavy cast-steel trunnions. It is raised or lowered to desired positions by wire cables connecting with electrically operated winches. The material is sucked up through a 26-in. pipe in the dredge arm and delivered to two 26-in. distributing pipes to the hopper bins.

There are six bins, three on each side of the well, having a combined capacity of 1400 cu.yd. These bins are fitted with overflow weirs which dispose of all surplus water. Openings are also provided below the level of the maximum capacity to permit the dredge to operate on a lighter draft if necessity demands. A trap gate in the bottom of the bins releases the material. The bins can be filled or dumped with dredges singly, collectively or in pairs. In order to keep the vessel from listing, especially in heavy seas, it is the practice to empty partly the two forward hoppers, then to dump the four after hoppers. The dredge actually fills the hoppers in 45 min. and it is able to dump its entire load in 7 minutes.

The lower end of the dredge arm is fitted with a drag head of the usual type used by sea-going dredges. The first drag head used was made of ordinary steel and was in serviceable condition for about thirty days of actual use. A new drag made of manganese steel has seen two years of actual service and has handled as many as 27 cu.yd. of material per minute over long periods of operation. The dredge arm has been operated in 42 ft. depth of water and in this position has an angle of 30° from the vertical. All movements of the dredge arm, pumping, disposing of material, etc., are mechanically operated, the chief operator's station being located conveniently to afford a clear view of all movements.

When dredging operations began in 1914 there was 17 ft. of water on the bar. Table I is a record of the first season's work of the "Michie."

TABLE I. FIRST TEN MONTHS' OPERATION OF DREDGE "MICHIE"

Month, 1914	Cu.Yd. Dredged	Days Dredge in Commission	Parts of Days Worked	Av. Amt. Dredged per Day	Max. Amt. Dredged per Day	Total Expense
January	4,719	9	2	2,?60	4,552	$3,835 30
February	10,308	28	6	1,718	4,094	3,442 44
March	14,890	31	8	1,861	4,094	2,996 91
April	48,475	30	16	3,029	4,650	3,343 28
May	65,786	29	21	3,132	4,893	3,843 48
June	Dredge rammed and sent to Portland for repairs					7,838 19
July	58,682	28	14	4,192	7,418	3,944 19
August	30,687	14	7	4,388	7,426	2,488 95
September	No work, due to lack of funds					
October	6,574	17	3	2,118	3,032	3,620 40
Total	240,121	186	77	3,118	7,426	$34,953 14

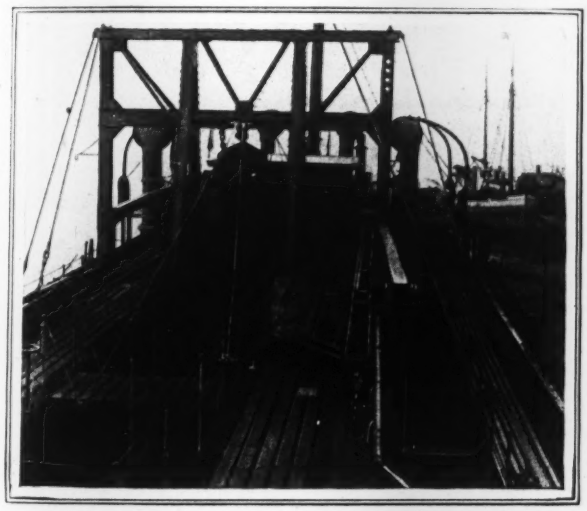
The unit cost of dredging for the season was 14.6c. per cu.yd., of which the labor cost = 6.8c. per cu.yd. and fuel oil = 3.1c. per cu.yd. The pumping average for the season was 14.5 cu.yd. per min.

Operations of work for the season of 1915 are recorded in Table II.

TABLE II. SEVEN MONTHS' OPERATION IN 1915

Month, 1915	Cu.Yd. Dredged	Days Dredge in Commission	Parts of Days Worked	Av. Amt. Dredged per Day	Max. Amt. Dredged per Day	Av. Cu.Yd. per Min.	Total Expense
May	40,520	20	9	4,502	7,170	22 8	$6,490 04
June	210,672	30	25	8,426	13,733	22 8	7,653 99
July	200,678	31	22	9,121	14,137	24 5	5,793 81
August	222,623	31	25	8,904	14,192	25 9	7,481 34
September	135,881	30	16	8,492	12,795	26 5	5,596 71
October	80,411	31	13	6,185	12,168	27 1	8,076 16
November	10,919	20	4	2,729	4,575	22 3	5,156 11
Total	901,704	193					$46,248 16

The unit cost of dredging for the season of 1915 was 5.13c. per cu.yd., of which the labor cost was 1.95c. per cu.yd. and fuel oil 1.6c. per cu.yd. Operations for the month of March give a record well worthy of consideration. This month the unit cost of dredging was 2.88c. per cu.yd. The costs given include all overhead expenses, including a 2% charge for Portland office expenses, but do not include the expenses incurred by the dredge while out of commission.



DREDGE WELL IN MIDDLE AND SPOIL HOPPERS AT RIGHT

All operations at all times are under the supervision of an engineer officer and during the first season's work careful inspection and study of conditions resulted in certain changes and improvements to overcome defects and increase efficiency. Operations for the year 1916 were of such a varied nature that the work accomplished could not be placed in comparison with the above tables. However, it is a noteworthy fact that the record is as worthy of consideration as that of the previous year. Maintaining a channel 30 ft. in depth above mean low water, 600 ft. in width and extending across the bar, is the object which the "Michie" has secured economically and successfully.

James H. Polhemus, Jr., junior engineer, acting under engineer officers of the army, is in charge of the operations of the dredge and to him the writer is indebted for the data used in this article.

Stringer Expansion Joints Reduce Floor-Beam Stresses

CONTINUOUS stringers without slip joints are used in the 416½-ft. truss span of the Great Northern Ry. over the Columbia River at Wenatchee, Wash., built in 1893. Extensometer measurements made recently, on both floor and truss members, showed that decided lateral bending of the floor-beams occurred under load, due to transmission of the bottom chord elongation to the floor. The stresses produced by this lateral bending are so high that it was considered necessary to eliminate them by introducing stringer expansion joints. Two such joints are now being put in.

John A. Bohland, bridge engineer of the railway, gives the design loading of the bridge as 4000 lb. per linear foot preceded by 124-ton locomotives having 34,000 lb. on each driving axle. The uniform load is virtually equal to the actual weight of present-day traffic, but the engine concentration is far below the weight of engines now in use. In consequence, the floor is taxed more severely than are the trusses. There is a double set of stringers, comprising main stringers under the rails, proportioned for the full load, and auxiliary stringers outside of these for service under derailed wheels. This extra provision of stringers leaves the floor-beams as critical points, and the lateral bending of the floor-beams is, therefore, especially objectionable.

The stress measurements were made under a test train consisting of one Mallet locomotive and a train of 100,000-lb. coal cars. The engine, one of the heaviest on the line, Great Northern Class N 1, was 93 ft. long and averaged 6710 lb. per linear foot on this length. The coal cars, whose gross weight ranged from 114,800 lb. to 143,600 lb., represented loads of 3000 to 3200 lb. per linear foot. The locomotive load exceeded the design loading by 70%, while the train load was 20% less than the design loading.

Under these conditions excessive stresses could be expected in stringers, floor-beams and floor beam hangers. The extensometer measurements showed the following stresses:

Location	Unit Stress, Lb. per Sq.In.
Diagonal	13,950
Lower chord	11,350
Upper chord	13,870
End Post	11,700
Floor-beam hanger	20,550
Floor-beam, vertical bending	19,820
Floor-beam, with secondary stress due to lateral bending	28,230
Stringer	12,050

The low stringer stress is attributed to the presence of the auxiliary stringer system, which evidently took part of the load.

The material for the two sets of stringer slip-joints is now on the ground, and the joints will be built in before winter.

Group of Small Towns Get Together on the Water Problem

Engineering Talent Shapes the Policy of District Throughout Preliminary Stages of the Development

THE MARIN Municipal Water District, on the north side of San Francisco Bay, affords an example of the effectiveness of the engineer's influence when directed toward getting several communities to cooperate in a common cause. Although the general features of this development are similar to those of many other water-supply projects, from its inception in 1912 it has had its policy shaped as well as its procedure directed by a competent engineer.

M. M. O'Shaughnessy, city engineer of San Francisco, was formerly a resident of Mill Valley, now in the water district. Becoming interested in the local water problem, he was made one of the directors of the water district. He advocated adopting the plan of development which would be best for the entire population of 25,000 resident in the ten or twelve adjacent towns (including San Rafael, Mill Valley, Fairfax, Sausalito, Ross, San Quentin and others), and through periods of active opposition succeeded in holding the various localities together on a plan for developing a supply jointly.

Organization Difficulties

After five years of preliminaries, construction is now well under way, and because the favorable outcome of the policy is apparent opposition has disappeared. In the early stages, however, a continuous struggle was needed to keep out prejudiced influence and satisfy the customers of the private water companies that the plans proposed by the district were for the best. A typical controversy was that waged on the question of dam sites fought out early in the history of the project.

The Marin Water and Power Co., one of the several independent companies whose total capacities were insufficient for the district, had planned an additional reservoir at what was called the Tamalpais site. This would have afforded storage capacity of 3,000,000,000 gal. at a cost of $513,800. With these figures before the district, and in the face of the private company's opposition, it took a deal of education to get approval for building a dam (now under construction) at the Alpine site, where the total cost for dam and conduit was $668,500 and the storage capacity only 1,000,000,000 gallons.

The Alpine site, two miles below the other, was chosen by the district because it was found that its drainage area would supply a minimum of 5,000,000 gal. daily as compared with 3,000,000 gal. from the Tamalpais drainage area. Thus, comparing the developments on the basis of cost per million gal. per day, the Tamalpais site figured $171,267 as against $133,700 for the Alpine site.

From the standpoint of immediate return on the investment, which was naturally the private company's viewpoint, the Tamalpais site was more attractive. With a policy looking to temporary rather than permanent relief, a comparison of the two sites would not place great weight on the possibility of large future increases of capacity, which was one of the important advantages of the Alpine site. These points serve to illustrate the difference in the two viewpoints, and indicate how natural it is for the modern "town dads" to find the community obliged to take over improvements representing comparatively heavy investments which would not have been made if some one who could see clearly the broad engineering problems presented had pointed out a better way.

There were other points on which there was work to do outside the pale of the engineer's ordinary sphere. Attempts to boost the price of the drainage area which the district wished to buy had to be met. A valuation from the California Railroad Commission was secured on the land, and this had to be tested out in the courts. Finally, when such preliminaries as these were cleared away, there remained the campaign for a $3,000,000 bond issue.

This campaign, like the previous work, was directed by engineering talent. Public meetings were arranged, lectures illustrated by moving pictures were given and a systematic program was carried out to educate the people to the necessity of the project, and to convince them of the wisdom of the particular course recommended. These methods succeeded and the bond issue was approved.

Features of the Project

During the five-year formative period engineering studies went on simultaneously with the organization work. It was established that the drainage area of 10.36 sq.mi. above the Alpine dam has an average rainfall of 65 in. per year, which is very much heavier than in adjacent territory, because this area is at a high altitude on the coast line and intercepts moisture-laden trade winds. The dam decided upon is an arched masonry structure with a central siphonic spillway. The initial height will be 100 ft., but the base width is being made 88 ft. and it is planned to increase the height to 170 ft. at some later date. The radius of the arch will be 465 feet.

For the present, a 24-in. concrete conduit, 3½ miles long, will convey the supply to Phoenix Lake, which is as far as is now required. In the conduit line, which is laid in bench cut on a 0.1% grade, there is an 8700-ft. tunnel. In the consideration of the size of this tunnel, it was pointed out that the cost of a large bore would be but slightly more than that of the minimum section which it would be feasible to construct, while the larger section would afford advantages in water storage and in capacity should the conduit be paralleled later by another line.

Accordingly, an 8-ft. circular section was adopted, and is being lined with concrete throughout. A comparatively circuitous route was selected for the conduit line in preference to a shorter one in order that (1) the supply might be drawn from near the deepest point in the reservoir and (2) that building a part of the tunnel under submerged area might be avoided.

Since the district was organized, A. R. Baker has been in immediate charge of the work as resident engineer, acting under the general direction of M. M. O'Shaughnessy.

Machinery and Footing Complications Control Mill Design

Three Different Kinds of Foundations—Cantilever Support for Columns—Concrete Brackets Carry Runways for Traveling Cranes

By W. Stuart Tait
Vice President and Chief Engineer, Concrete-Steel Products Co., Chicago

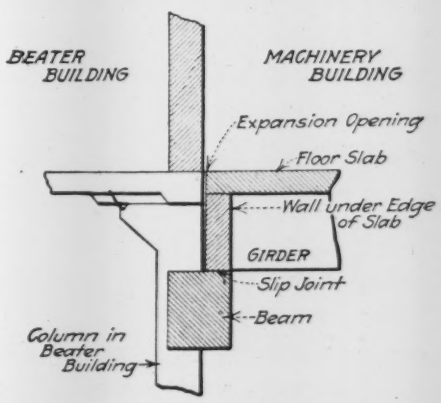
BEATER MACHINERY EXTENDS THROUGH SECOND FLOOR

A VERY soft subsoil and a complicated machinery layout were the controlling factors in the design of the paper-manufacturing plant erected in Chicago during 1916-17 for the Chicago Mill and Lumber Co. The plant consists of a beater building, machinery building, warehouse, engine house and boiler room. The foundations under the different buildings of this one plant include concrete piers sunk to rock, concrete footings and a concrete mat. Cantilever girders and footings carry some of the columns (over soft ground, near adjacent buildings, and over a sewer), and a loading platform is carried in the same way. In one building the foundation piers are widely spaced, and alternate columns are carried by heavy girders supported upon these piers. Other notable features include the support of crane runways by brackets on the concrete columns, cantilever beams to support machinery, expansion joints between adjacent buildings, and self-supporting filter tanks formed by heavy girders between the foundation piers. Even steel structural features of special interest are included, in the shape of heavy shallow roof trusses whose bottom chords constitute runways for the cranes.

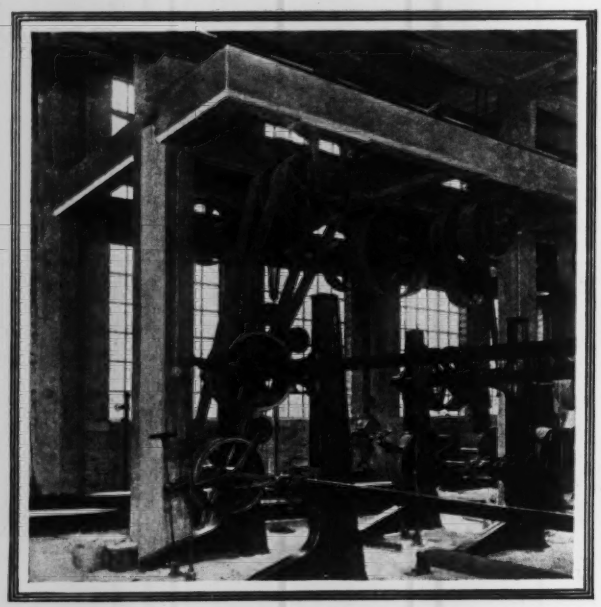
The beater building is 80 x 110 ft., with a basement and three stories. On the first floor are placed the beaters used to reduce paper and rags to pulp, and the basement is occupied by the drainers, stuff chests and tanks. The upper floors are for the storage of baled paper and rags.

The ground at the site of the building, which is adjacent to the Chicago River, is extremely soft, and it was necessary to carry the building on concrete piers built in open wells or caissons sunk to bedrock at about 60 ft. below the surface. In this building the columns are spaced 16 ft. c. to c. in one direction and 18 ft. in the other. It was found that one 4-ft. pier under every other column in the 16-ft. direction would carry the load satisfactorily.

It was also found that it would be cheaper to put in a girder between these caissons to carry the load of the intermediate columns than to sink additional caissons at these points. The basement-story column-load on the typical interior column is 392,000 lb. To carry this load on the center of a 32-ft. span, a girder 48 x 72 in. was provided, reinforced with 21 bars of 1-in. square steel,



EXPANSION JOINT BETWEEN ADJACENT CONCRETE BUILDINGS



CONCRETE CANTILEVER BEAMS CARRY SHAFTING

and stirrups, as shown. Each floor was designed for a live-load of 250 lb. per sq.ft., and one more story (to be added later) was provided for in the design.

The basement floor being considerably below the water level of the Chicago River, it was necessary to reinforce this floor to resist the upward pressure of the water. It was also necessary to take special precautions with the wall and basement-floor construction to insure an entirely waterproof construction. No waterproofing whatever was used in these floors and walls. The concrete, however, was carefully graded so that the voids were reduced to a minimum. Care was taken also to get a mixture of concrete with the correct amount of water, guarding against a very sloppy mix on one hand and a dry mix on the other.

Along the west end of this building a loading platform is provided, and as no satisfactory support could be obtained for the edge of this, owing to the poor quality of the soil, it was decided to cantilever from the foundation girders to carry the edge of this platform. This is shown in one of the foundation drawings. Both in this building and in the machinery building concrete brackets are provided on the sides of certain columns to support the crane-runway girders.

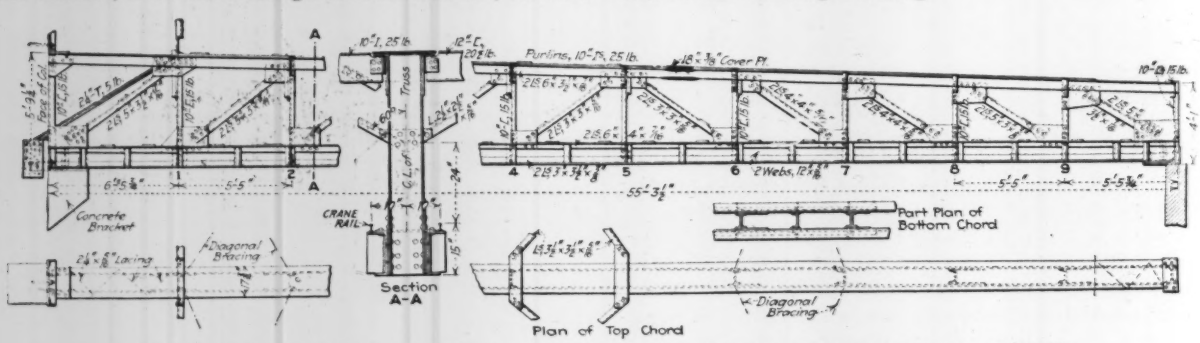
The first floor of this building, which is occupied by the beaters, is of beam-and-girder construction, and the walls of the drainers and stuff chests in the basement are in some cases used to support this slab. The upper floors are all cantilever flat-slab construction, as will be seen by the illustrations.

The machinery building is 257 x 44 ft. It has a basement and three stories and is designed for a future extension and an additional story. The basement is occupied by a filter plant and by a "save all," which is a tank to catch the pulp dripping from the paper machinery above. Here, as in the beater building, it was necessary to reinforce the basement floor against upward water pressure. The main paper machinery rests on the first floor. A portion of this extends through the second floor, which is open at this part of the room. The upper stories are used for the storage of baled paper and other raw material.

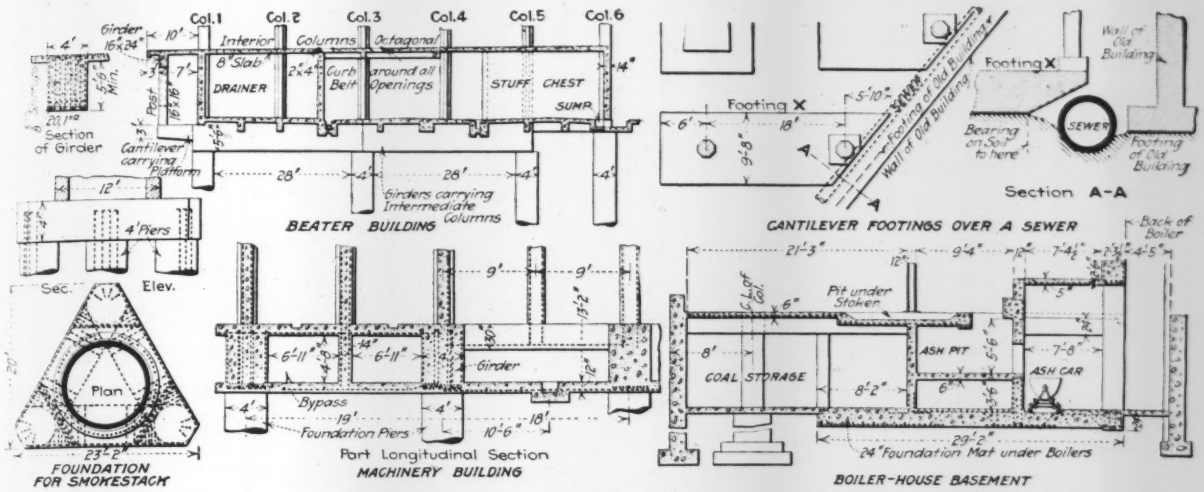
This entire structure is carried on concrete-pier foundations, and on account of the soft nature of the soil it was deemed advisable to build up the filters as self-supporting structures, not relying on the ground to carry them. Accordingly, concrete girders were placed on top of the caissons, and the walls of the filters were designed as beams to carry the load to these girders. These girders are 48 x 80 in., and those which are typical under the filters are reinforced with 25 bars 1 in. square. The filter bottoms spanning between these girders consist of 12-in. concrete slabs reinforced in one direction with ¾-in. rounds, placed 6 in. c. to c. The filter walls are 14 in. in thickness, reinforced in each side, provision being made in this way to allow of alternate filters being full and empty. The foundations for the paper machinery are carried on similar girders of about the same size.

An interesting detail is the use of cantilever beams to carry certain shafting and pulleys in this building. The upper floors of the buildings are all beam-and-girder construction, the main span being 31 ft. On account of this long span and the heavy floor load, the beams were unusually large.

The warehouse building abuts on the east end against an existing storage warehouse. The footings of the latter extend out beyond its walls, and immediately to the west of this footing a large sewer had been built. The wall of this existing warehouse had not been prepared for any future extension, so that the new structure had to be entirely independent. It was decided, therefore, to place the first of the columns approximately 4 ft. away from the face of the wall. Owing to the position of the sewer, it was impossible to obtain any bearing on the soil nearer than a point 7 ft. from the wall of the existing building.



SHALLOW STEEL ROOF TRUSSES MADE HEAVY ENOUGH TO CARRY TRAVELING CRANES



FOUNDATION DETAILS VARY IN DIFFERENT BUILDINGS

The method of construction used for these cantilever footings is shown in the illustrations. It will be noted that the columns adjacent to the old building overhang the point where the foundation bears on the ground by approximately 3½ ft. The first floor of this building is designed for a load of 400 lb. per sq.ft. and the others for 250 lb. All are of the cantilever flat-slab type.

The over-all length of this plant is approximately 450 ft. The machinery building has one end abutting against the beater building, while its other end overlaps one side of the warehouse. The adjacent beater and machinery buildings are carried on caisson foundations, while the warehouse is on spread footings. It was decided, therefore, that an expansion joint would have to be provided between the beater building and the machinery building, and another between the machinery building and the warehouse. The detail of this expansion joint on the former of the buildings is shown.

At the junction of the machinery building and the warehouse it was not possible to use an expansion joint of the type shown, as settlement would undoubtedly take place in the latter building. Accordingly, the corner of the warehouse is cantilevered out to form a connection to the machinery building in a manner similar to that used at the east end of the building where it abuts on the old warehouse, as previously described.

In order to obtain light and ventilation in the portion of the machinery building adjacent to the engine room, the height available for these roof trusses was limited to 5 ft. 9 in., while the trusses were 55 ft. in length. It was also necessary to provide for carrying 5-ton traveling cranes on the bottom chords of these trusses, and consequently it was not possible to insert any horizontal bracing at the bottom chords. The vertical members of the trusses, therefore, were designed to take bending, and knee braces were provided to resist this twist.

STEEL ROOF TRUSSES CARRY TRAVELING CRANES

These vertical members consist of 10-in., 15-lb. channels set with the web normal to the truss span. It will be seen from the drawing that the centers of the crane rails are 10 in. from the center of the truss. The reaction from the crane wheels at these points is 14,000 pounds.

All the engines are carried on massive concrete foundations resting on caissons again carried to bedrock. The roof of this building is of steel trusses carrying gypsum tiles placed between T-irons and covered with a 2-in. cork insulation.

The boilers are carried on the first floor, of reinforced-concrete construction. The basement of this building is occupied by coal storage, ashpits and an ash-disposal track. A mattress foundation of reinforced concrete, approximately 21 in. thick, was used over the entire area occupied by the boilers. Columns at the back end of the boilers and others under the stokers, and the ashpit walls, carry the weight of the boilers and other equipment to this foundation. The mattress foundation resulted in a pressure on the soil of a little over one ton per square foot and proved more economical than a caisson construction. This foundation is shown in one of the drawings.

To provide for a large increase in capacity the three main buildings were designed for one additional story. The beater building, machinery building and boiler room were also designed for extension of area.

In preparing the column designs for these structures, careful comparative cost estimates were made covering the use of 1:1:2 and 1:2:4 concrete. It was found that in spite of the high cost of cement, the richer concrete would be more economical, while its use resulted in smaller columns.

The architect was Louis Guenzel, and the mechanical equipment was designed by James L. Carey. The buildings were designed by the Concrete-Steel Products Co. and were built by the Mueller Construction Co. All these are of Chicago.

Plastic Cement Resists Locomotive Blast

PLASTIC MATERIAL to protect the undersides of bridge floors from the blasts and gases from the smokestacks of locomotives is being tested on the Atchison, Topeka & Santa Fe Ry., as a substitute for the hard and dense materials usually used for this purpose. The material is Toch Bros. self-healing bridge cement, which has been used especially for the waterproofing of bridge decks. It gets its name from the fact that if the coating is cut or torn the cut is closed or sealed automatically by the flow or creeping of the cement. It is a viscous material that does not harden. It will not flow in hot weather and retains its elasticity even at very low temperatures. A coat of this material is brushed upon the concrete or other surface for a suitable width over the center of the track. It is not affected by the heat of the exhaust, and sparks and cinders become embedded in it. When this coat is well filled, a second application is made on the rough surface, the operation being repeated until a coating about 1-in. thick has been built up.

This form of blast protection was devised by A. F. Robinson, bridge engineer of the Atchison, Topeka & Santa Fe Railway.

Road Maintenance Is Receiving Attention in Wisconsin

Local Authorities Realize That Maintenance Must Supplement Construction—Neglect Means Roads Damaged and Money Wasted

RECOGNITION of the principle that road maintenance is essential to the permanent efficiency and economy of a good-roads system is urged emphatically in the latest biennial report of the Wisconsin Highway Commission. Neglect of road maintenance by local authorities after the expenditure of considerable money in construction has been a general and costly practice in this and other states. There is a gradual change to better conditions, but the rate of progress is slow.

State Supervision of Maintenance Needed

Under the Wisconsin state-aid law roads constructed according to its provisions must be maintained by and at the expense of the counties. Originally, this applied only to roads that had been surfaced, but in 1915 the law was amended to provide that earth roads built with county and state funds must also be maintained by the counties. This change was made on account of the neglect of the latter class of roads by the county authorities, so that in many cases the state-aid earth roads were in bad condition.

Unfortunately, there is no sufficient control of this situation. The highway commission has only very indefinite authority over road maintenance, this being exercised under provisions which give it general supervision over the construction and maintenance of all roads and bridges built under the state-aid law. It is true that the commission may refuse to allot further funds to a county which does not maintain the state highways adequately. This power has not been employed, however, as in most cases it would tend to penalize towns which have no direct control over maintenance.

Bad condition of roads due to neglected maintenance has led to complaint as to material and construction. The report states that virtually all of the criticisms of the maintenance of state highways have been caused by the fact that many of the stone and gravel macadam roads have not been kept up by the counties, and have therefore deteriorated in a few years and sometimes in one season. In consequence, macadam and gravel construction has been criticised severely as unsuitable for Wisconsin roads, when, as a matter of fact, the type of construction has been in no way to blame for unsatisfactory results.

Lack of Maintenance Condemns Macadam

This dissatisfaction, however, has resulted in a demand for concrete or some other of the higher and more expensive classes of road surfacing. The commission points out that while such surfacing may be desirable and economical on certain main lines of travel, the state cannot afford to apply it to the entire system of state highways. For the greater part of this system, and for all roads of a secondary character, the surfacing must be largely of stone, gravel or other material that is available locally.

Roads of stone and gravel construction were virtually unknown in Wisconsin when the state-aid law went into operation in 1911. In the work started under this law the stone-macadam cost over $3500 and the gravel-macadam over $2500 per mile. The people of the local communities conceived the idea that roads built at such cost would be permanent and would require no maintenance.

That maintenance of roads of this type should be commenced as soon as the roads were built has been urged by the Highway Commission consistently and from the outset. It has pointed out also that in many cases the first year of the road's life is the critical time. In spite of this, the county authorities continued to build the roads and neglected to make any provision for their maintenance. The roads suffered deterioration, therefore, and the report states that some of them were almost destroyed, at least so far as the surface was concerned.

When this condition of cause and effect became evident to the communities and the local authorities, they began to heed the advice of the commission, and in 1914 maintenance with surface treatment was commenced on a small scale. In 1916, a majority of the counties took up the problem energetically, and made rapid progress with the repairs that had become necessary. The maintenance consists generally in surface treatment with tar or asphaltic oil, a cushion coat of bituminous material and sand or stone chips being placed on the old gravel or stone. This has been successful in most counties. It is estimated that as the result of the commission's continued campaign of education fully 66% of all the macadam roads built in the state within the past five years received surface treatment during 1916.

The report points out that in the matter of maintenance, as in other features of highway development, the general public as well as the county officials have had to be educated. Furthermore, the repeated efforts of the commission in such education went unheeded until it was almost too late to remedy the fault. The mischief is not undone entirely, for the public bears in mind roads that virtually went to pieces. Therefore, it has still blamed the original construction, failing to realize that the good roads they have now are of similar construction but are kept in good condition by regular maintenance. On the other hand, where the badly neglected roads have been well repaired, the people of a county appreciate at once the improved conditions and demand proper maintenance.

Maintenance methods in use in Wisconsin are still crude, says the commission, in spite of the great improvements effected. The patrol system is recommended as a further step in advance, and the report advocates its introduction in every county. Under this plan, the system of surfaced roads would be divided into sections, each with a patrolman to attend to ruts, holes, raveling, washed ditches, etc., as soon as they occur.

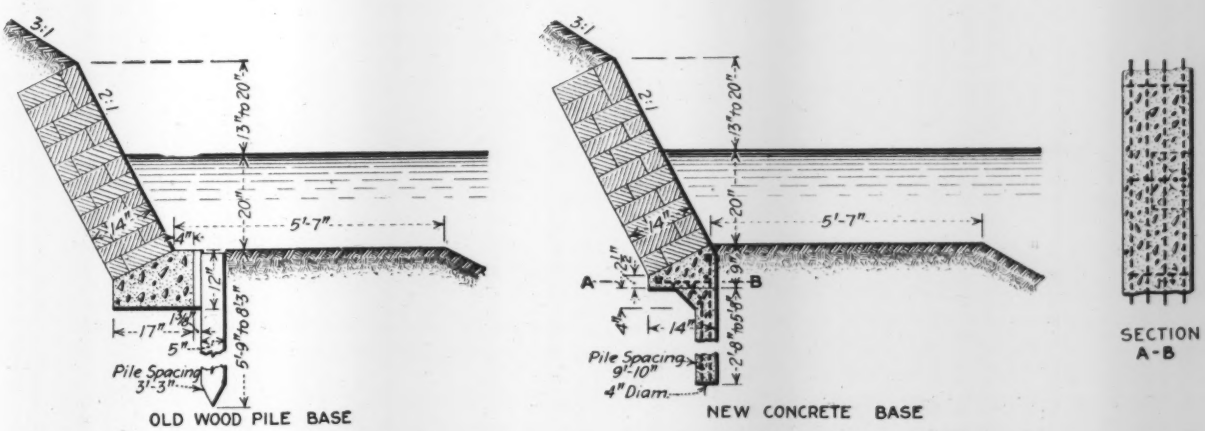
It is considered that complaint as to the macadam roads will disappear almost entirely if the following three steps are taken: Arranging for patching surface defects with bitumen and stone as soon as possible each spring; giving a surface treatment of tar and asphalt during the early part of the summer; and placing on each section a patrolman to care for the roads during the remainder of the season.

The report closes with the following sentence: "If some such system of maintenance is not adopted, and the counties continue to build stone and gravel roads and then allow them to care for themselves for years, it is absolutely true that these types are entirely unavailable for use under modern traffic conditions."

J. G. D. Mack is chief engineer of the state, and A. R. Hirst is state highway engineer.

Reinforced-Concrete Sill Foundation for Brick Bank Protection

THE old bank protection of one of the shallow French canals comprised a 14-in. brick wall set in the 1:2 slope of the bank and resting on a concrete sill. This sill was held against horizontal displacement by continuous wood planks, backing in their turn against 5-in. wooden piles spaced about 3 ft. 3 in. on center, all according to the detail shown in the left-hand drawing of the two shown. Although a considerable length of such construction had been put in, it was found to be impracticable, because the wood soon rotted out during the periods before the canal was watered or during the time when it was not in service.



OLD AND NEW METHODS OF HOLDING BRICK WALL BANK PROTECTION ON A SHALLOW CANAL

As an improvement on this detail, therefore, the engineers devised the one shown by the right-hand drawing; that is, they substituted for the combined concrete and wood sill a reinforced-concrete sill. This footing structure is made up of reinforced-concrete piles about 4 in. in diameter and from 2½ to 5½ ft. long, spaced somewhat over 9 ft., c. to c., and carrying a continuous sill which slopes on the side to the angle of the brick wall. The piles were made by boring a hole in the ground with a long-handled auger and filling this hole with concrete after the proper reinforcing rods had been placed. On top of each pile was a small rectangular head, cast at the time the pile hole was filled. After a stretch of these piles had set, the concrete sill itself was placed.

The bank protection has proved very successful and quite as cheap as the wooden ones formerly used. It is described in the May-June *Annales des Ponts et Chaussées.*

Council-Commission Government Rules Jacksonville

THE latest experiment in municipal government is being conducted at Jacksonville, Fla. One morning Jacksonville was being governed by a city council, a board of trustees for water-works and improvements bonds (which included a committee on public works, a board of health and an election commission) and a port commission. Twenty-four hours later the citizens awoke to read that on the previous day both branches of the Legislature, under suspension of the rules, had changed the city charter to provide for government by a council and a commission.

The new commission of five members has much the same function as a city manager under the commission-manager plan. It elects one of its members as chairman and he serves as mayor ex-officio. The councilmen, the commission itself and the city recorder, treasurer and judge are elected by popular vote, and all others are appointed by the commission, which also employs all laborers. The council affirms the appointment of library trustees, charity commissioners, city attorney and members of the police force, and appoints a special auditor annually. The commission frames the annual budget and its approval of all contracts and warrants is required to make them legally effective.

The present mayor and council will hold office until June, 1919. The council appointed the first commission, which took office July 3. Subsequent commissioners will be elected by popular vote for four-year terms. Each of the five commissioners will receive a salary of $5000 a year and must give a bond of $50,000. When the new plan goes into full effect there will be 18 councilmen, 11 elected one from each ward and 7 at large, each paid $240 a year.

Make Borings First

As a preliminary to the location of the Gilboa dam and the 18-mile Shandaken tunnel, for the development of the Schoharie watershed, part of the Catskill water-works for New York City, the Board of Water-Supply had made 350 borings, aggregating nearly 40,000 ft. in length. This information is from the board's annual report for 1916, just issued.

New Piggery in Topeka Utilizes Garbage

Steel Cans Are Transferred from Collecting Wagons to Motor Trucks for Delivery to Farm

OBEYING the conservation call to utilize municipal wastes, Topeka, Kan., is now turning its garbage into pork. Last spring a contractor under $5000 bond agreed to collect all garbage, including that which previously had been going to private scavengers, and to feed it to hogs outside the city limits. Daily collections are stipulated, except that from Nov. 15 to Apr. 1 bi-

GARBAGE CANS ARE WASHED EVERY DAY

weekly collections are to be made in the residential districts. There is no money consideration in the contract, but the city must prohibit private scavengers from taking the "fat" garbage from hotels and eating houses and must enforce ordinances relating to the placing of individual cans in or near the alleys. The contractor must maintain a sanitary establishment and his collection system must not create a nuisance.

Although the operation of the piggery was begun as late as June, the collection methods have been systematized and perfected to such an extent that the complaints had been reduced to seven or eight daily from the 45,000 inhabitants when the plant was visited in August by a representative of *Engineering News-Record.* These complaints are largely from collections missed, the cans not being placed in conspicuous places.

Both the collection system and the piggery are in charge of a graduate of an agricultural school, who reformed the collection methods when he started the piggery. Definite routes for collectors, in conformance with the class of the district, have been laid out, so that a man always covers the same territory. In general, the routes are long, narrow strips starting either at the river or at Twentieth St., but ending so that they will be nearest to the existing crematory, where all loads are brought for transfer to motor trucks. By this arrangement the trucks can be operated continuously between the crematory and the piggery.

Six collectors, working from 7 a.m. to 4 p.m., are employed during the week. Their routes are charted on a map so that at any time the wagons may be located and checked up as to efficiency by the superintendent.

On Sundays two collectors cover the hotels, restaurants and drug stores, getting about 18 cans. The summer week-day collection amounts to 55 or 60 cans of 418 lb., average weight.

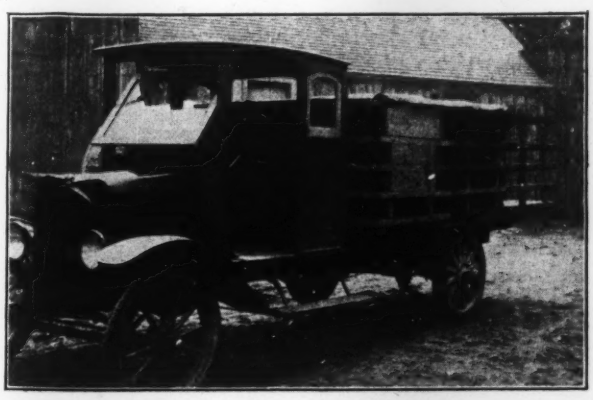
The 55-gal. steel can was adopted because it can be kept clean by washing, it is easily transferred from the wagons to the truck or to the loading platforms, and because the use of metal permits the exposure of only a minimum of garbage when the collections are being made. After return from the piggery the cans are washed every day at the crematory by the drivers and an extra man.

When loaded on the trucks the metal lids are removed and all the cans are covered with a canvas. This facilitates dumping at the farm and reduces the nonrunning time of the truck.

Six trips a day are made by the Smith Form-a-Truck to the piggery, which is 2½ miles from the crematory. Of this distance 1½ miles is over brick-paved streets within the city limits, and the remainder, with the exception of 300 yd., over a limestone rock-dust county road. It is planned to have the unimproved section paved before winter. Occasionally it is necessary, on account of repairs or heavy collections, to hire an additional truck to help out the 1½-ton truck on which are loaded eight or nine cans.

A herd of 800 hogs is now being fed at the piggery on a 15-acre tract, through which a railway track passes. Only grown hogs, six to nine months old, and thin, are fed. They are purchased in the open market at Kansas City. Immunization against cholera is practiced, the superintendent doing the vaccinating. Less than 10% of the usual loss has been sustained.

It is intended to fatten the hogs for market within four months. Only garbage is fed now, but the addition of corn to the ration, toward the end of the fattening period, is proposed. About 50 lb. per head of fatteners is fed, but this is considered entirely too liberal an amount. From the food-value standpoint 20 lb. are considered enough, particularly of the rich "Avenue" garbage. As the larger quantity is not all consumed, thin hogs, stockers, are turned in after the fatteners. Giving an example of the gain, the superintendent said that 85 hogs, weighing 115 lb. each, gained 75 lb. in a month, but further increase in weight is always slower. Refuse left on the feeding platforms amounts daily to two wagon loads. It is cleaned up each day, hauled to an unused part of the lot and plowed under.



WHEN GARBAGE CANS ARE FULLY LOADED, A CANVAS REPLACES THE INDIVIDUAL LIDS

At present three men are employed at the farm, one man cleaning floors, one hog man and one fence builder. Creolin is used to keep down the fly nuisance.

The concrete feeding platforms consist of two 6-in. plain concrete slabs 10 ft. wide and 190 ft. long, with a driveway 10 ft. wide between the platforms. Felt expansion joints, 1 in. wide, are placed 30 ft. apart. A 4-in. curb around the edges of the slabs prevents an excess of garbage from being pushed off to the ground. This fall a shed is to be built over the driveway and platforms, but as no breeding of hogs is intended, no elaborate pen system is planned. The seven different yards now connect directly with the platforms. The number of hogs maintained in each yard does not exceed two hundred.

Running water, from a spring at the upper end of the farm, is carried in troughs through each of the yards. To increase the capacity a well is to be drilled and a tank erected, from which water will be piped to the various pens for drinking and for washing the platforms.

Leroy L. Shoemaker is superintendent for the Mid-Continent Hog Co., of Denver, contractor for disposing of the garbage. W. L. Porter, commissioner of parks and public property, has charge of waste disposal for the city.

Incase Wood Trusses in Concrete To Resist Acid Fumes and Fire

CASING TIMBER roof trusses in cement to protect them against fire and acid fumes is a novel method employed recently in the buildings of a large oil refinery in Texas. Wood construction was adopted on account of the shortage of structural steel. After the trusses had been erected, each member was wrapped with a single layer of light waterproof building paper, placed close against the surface and fastened with carpet tacks. The object of this covering is to prevent any bond between the concrete and the wood and to protect the latter from the moisture used in applying the concrete casing.

Sheets of expanded metal with ½-in. diamond mesh were then cut and shaped to fit the members and fastened by No. 12 nails and special chairs stamped from flat-steel strips. These chairs kept the expanded metal ⅝ in. from the surface so that it would be embedded completely in the concrete.

Guide strips were tacked along the edges of the members to obtain the proper thickness of casing and to act as striking boards for the corner lines. With the work thus prepared, a 1½-in. coating of cement mortar or "guncrete" was applied with cement guns. These operated under an air pressure of 35 lb., supplied by two oil-driven compressors, each having a capacity of 250 cu.ft. per min. Before this coating had fully set, the guide strips were removed, and the surfaces left with an even finish.

The roof covering consists of a 1½-in. monolithic slab, built in place. Over the trusses and purlins was stretched a sheet of wire-mesh reinforcing secured by nails and chairs as noted above. Light wood panels

were then laid upon this and the concrete for the underside of the roof slab was shot in place by the cement gun. After about 24 hours the wood panels were removed.

The concrete surface was then cleaned with compressed air and water to secure good bonding for the top coating, which was placed in the same way. Finally a thin coating of hot asphalt paint was applied. This work was done by the Cement-Gun Construction Co., of Chicago.

SOCIETY SERVICE

A Section Dealing with the Results of Teamwork by Technical Men

New Columbus Club Gets Close to Business Men

MUTUAL STRENGTHENING of the Columbus Engineers' Club and the Chamber of Commerce, at Columbus, Ohio, resulting from an intimate relation between the two organizations, is considered by the chamber of sufficient value to justify its granting to the club the use of a small room for the club library, the occupancy of the chamber's auditorium whenever desired, and the use of a multigraph machine, an addressograph, and a folding machine with the services of an operator for these machines, together with stenographic facilities and the services of telephone operator. No payment is asked, and it is stipulated definitely that the chamber will not wish or expect to dictate the policy or any action of the club, but it intends to ask the club for advice on many questions of an engineering nature.

Other engineering societies have attempted to form close affiliations with business men's organizations, but none seems to have succeeded to so great an extent. Perhaps the objects of the Columbus club have in view more community service than have most other societies. The Columbus Society's objects are: "To advance scientific and engineering knowledge, to acquaint the public more completely with the importance and value of engineering work; to assist the officials of the city and civic organizations in public questions of an engineering or other nature as opportunity offers, and to promote acquaintance and fellowship among the technical men of Columbus and vicinity." The club represents the latest ideas in local society development; it was formed last spring after consultation with those who have been engaged most actively in promoting the "home service" idea. Its success is attested by the fact that its membership has already reached two hundred and fifty.

At the opening fall meeting, L. R. Lee, chief engineer of the E. W. Clark Co., gave an illustrated description of the process of designing the new power house of the Columbus Railway & Light Co. on Big Walnut Creek, south of the city. This introduced successfully an exchange of views on the subject among the members, who are a goodly mixture of university, city, state and corporation engineers.

C. P. Hoover gave a demonstration of water clarification and softening as practiced at the city plant. He dwelt on the probable new low typhoid record to be made this year (5 per 100,000, as against the highest rate in the country in 1908). To enable each engineer in the city to be a missionary among his laymen friends and talk intelligently of operation, he explained that when the water is clear but hard in the dry season, the treatment costs are five to ten times as high as when it is turbid and soft in flood stages. In like manner the savings effected by the use of alum pulp were explained.

City Council Fosters Engineers' Club

The Engineers' Club of Houston, Tex., is valued so highly by the city fathers that they are willing to turn over the council chamber, without charge, for the monthly meetings of the engineers. Beginning with the engineers in the city service, this organization, which is probably without counterpart in the country, has now a mailing list of 150 names. There are no dues and no constitution and no set objects. A chairman is chosen to preside for two meetings and J. C. McVea, assistant city engineer, takes upon himself the sending out of notices of meetings. At the end of a meeting the chairman appoints a committee to furnish a program for the next one. The hat is passed when more postage stamps and stationary are needed. The printing is done on the city multigraph. At the August meeting the subject of engineering education was discussed, and this led into discussion of compensation, status and other social and welfare subjects. The previous meeting had been given up to the question of joining the American Association of Engineers as a body. Differences of opinion in the matter developed, and the club concluded to continue its free, democratic existence.

Each year it is the custom to celebrate with a banquet the anniversary of some patriotic or historic occasion, such as the birth of Sam Houston or the declaration of Texas independence. The mayor acts as toastmaster, and prominent business men of the city are invited. Blueprint menus depicting historic events and characters and songs specially written help the engineers to fraternize with those who are doing things in this lively southwestern city.

The secretary of the American Association of Engineers made recently a tour of Eastern cities to learn the feasibility of an affiliation plan for local engineering clubs and societies. He reports that the officers of local organizations in Pittsburgh, Washington, Baltimore, Brooklyn, Boston, Cleveland and Detroit expressed general approval and support of such a plan. Definite written proposals were asked for. The secretary concludes that the increased demands for engineering service, due to the war, has brought a realization of a greater need than ever for engineering society activities, to handle the problems of national distribution of engineering services.

Oakland Dumps Garbage in Bay

Floating piles, chained end to end, confine the garbage of Oakland, Calif., to definite dumping areas of San Francisco Bay. Following a complaint the State Board of Health investigated the method and found no serious nuisance has been created so far, because the piles effectively prevent scattering of the garbage.

LETTERS TO THE EDITOR

Comment on Matters of Interest to Engineers and Contractors Will Be Welcome

Asphalts at Louisville Cantonment

Sir—In the article on the Louisville cantonment which appeared in *Engineering News-Record* of Aug. 30, p. 412, it is stated that in the road constructed by the Bickel Asphalt Co. Bermudez and Mexican asphalts were used. This is an error. In a letter under date of Sept. 4, the Bickel Co. says: "It was this company's intention originally to use a mixture of 60% Trinidad and 40% Mexican, but after looking over the situation and seeing the enormous travel which these roadways would have to carry, we decided to use straight Trinidad."

You will observe that neither Bermudez nor Mexican was used in this work, but that it was all laid with Trinidad. A remarkable construction record was established on this work, the Bickel Co. completing 63,360 sq.yd. of pavement on concrete base in 63 working days. Considering the difficulties under which the work was done, this was a remarkable performance on the part of the contractor.

D. T. PIERCE,
Executive Assistant, Barber Asphalt Paving Co.
Philadelphia.

The Demand for Engineers

Sir—The undersigned was much interested in the letter signed "Electrical," contained in *Engineering News-Record* of Oct. 4, p. 658. He regrets that much of the letter is quite true and feels that the engineering profession as a whole is greatly responsible for the condition described. It has been the practice for large electrical manufacturing concerns to give obsolete equipment to technical schools, and by thus securing their good will obtain cheap labor for office and shop, by offering inducements to the graduate students. Although these men, through lack of practical experience, are not qualified to receive the pay of engineers, they should receive much better wages than is usually given them. Many of these young men become disgusted with the treatment accorded them, and become bitter enemies and successful competitors of their former employers.

A small proportion of the graduates thus obtained stick to the concerns but continue in most cases to draw very small salaries, as their employers know that each year will bring forth a fresh number of students to draw from. The fairly good positions are commonly filled by practical men who have had little technical training. Although in no sense engineers, they find no difficulty in hiring technical men to do engineering work at the wages of skilled labor. The great trouble with the engineering graduates is that it is often impossible for them to know the relative value of positions offered them. They are often the victims of employers who bleed them of technical information while making them believe they are virtually worthless because they lack practical experience. Although we engineers are insisting on good character, etc., the early practical experience of many students tends to discourage the growth of such qualities. There is certainly a much greater demand for technical high school students than for those having a more extensive training. The present war may provide openings for many who otherwise would have to take up other kinds of work.

The writer does not wish to minimize the importance of a first-class technical education, as it is becoming recognized that the engineers are the leaders of the world of today. He does wish, however, that the technical students should receive correct advice, fair play; and that the various publications of the large engineering societies would stop printing advertisements asking for engineers at low salaries. The general public should be educated in placing the engineer in the station which is rightfully his.

CONSULTING ENGINEER.

Rapid Stadia Survey Costs

Sir—The cost data given by L. R. Howson in his article entitled "Rapid Stadia Surveys Cover 50,000 Acres," in your issue of Sept. 27, p. 606, would, I fear, prove a snare for anyone who should contract to produce a map for the same prices. Will not Mr. Howson give us more detail in regard to his work, such as what was shown on the map from an average of less than 1½ stadia "shots" per acre—and just what is included in his total costs of 10.8, 8.07, and 17.35c. per acre?

A few years ago the writer completed a survey of about 5000 acres of rough country, partly cleared and partly wooded, including two villages and many farms, taking contours at 5-ft. intervals throughout. His total cost per acre for wages of field parties and draftsmen was 52.3c., but other expenses, properly charged, raised the total to $1.769.

In the published article, should we not have a substantial addition to the given costs for depreciation and maintenance of three automobiles, depreciation or rental of instruments, supervision by principal assistant and resident engineers, transportation and subsistence of field men, and perhaps other items?

Brookline, Mass. FRED J. WOOD.

[A copy of the letter was sent to Mr. Howson, and his reply follows.]

Sir—The costs given in my article entitled "Rapid Stadia Surveys Cover 50,000 Acres" cover field costs only. The field costs, however, include the salaries of the men in the field and the field draftsmen, a part of the salary of resident engineer, which was chargeable to the surveys, the cost of subsistence of the parties, transportation, general supplies and the maintenance of all equipment, including automobiles. The costs did not include any allowance for the general supervision of the chief engineers, which, on account of the nature of the work, was small, nor for the fixed charges on instruments or automobiles. The complete data for one of the automobiles was given on p. 518 of *Engineering News-Record* of Sept. 13.

The field draftsman prepared a map on detail paper only; this was later traced in the office and the cost not included in the tables of the article. The maps showed fence lines, culverts, buildings, roads, woods, etc.; also traverse lines and contours at 5-ft. intervals. Shots were taken at all changes in slope, and where the slopes

were uniform over large areas, they were taken at 200- to 300-ft. intervals. One shot per acre is equivalent to an average spacing of readings of 208-ft.

Mr. Wood refers to his cost of 52.3c. per acre for a 5000-acre survey "of rough country, partly cleared and partly wooded, including two villages and many farms." This may not be out of line with the Columbus survey costs, for the surveys of the Delaware and Flint reservoirs, which are of adjoining areas, varied more than 100% in cost, due to topography and the size of reservoirs surveyed. The first 5000 acres of any large survey will invariably cost very much more than the average (all other factors being the same), on account of the cost of organization, the breaking in of the party, time spent in arranging transportation, sustenance, etc. The cost of the first 5000 acres surveyed for the Dublin reservoir at Columbus cost nearly double the average cost for the 18,000 acres. The cost per acre will also vary directly with the roughness of the topography, which was the principal reason for the comparison of the three surveys at Columbus along the lines set out in the weekly reports, one of which is reproduced in my article.

L. R. HOWSON.

Chicago.

Should Projection of Piles Into Concrete Be Limited?

Sir—Specifications for substructures often contain a clause similar to the following:

"The tops of the piles shall project not less than 12 in. or more than 18 in. into the concrete after all damaged wood has been cut off."

A bridge now under construction in Illinois will rest on piles driven 5 to 8 ft. through soft mud down to a hard stratum on which the piles bring up short. To give steadiness to the piles under these conditions the engineer will fix the cutoff about 6 ft. above the bottom of the abutment, so that the piles will be gripped firmly by the concrete. There is ample precedent for letting piles project far up into the concrete for obtaining a thorough anchorage effect, but under the specification clause above quoted this construction would appear to be ruled out.

The question arises whether such a clause should be qualified by excepting special cases, or whether it may be omitted without disadvantage.

CONSTRUCTOR.

Areas of Segments of Circles

Sir—Referring to the article entitled "Table Gives Areas of Segments of Circles" which appeared in the Sept. 6 issue of *Engineering News-Record*, p. 470, I beg to bring to your attention that in problems of this kind the cumbersome, exact formulas can always be transformed and simplified so as to yield expressions which are simple as to form and application and which can be made as accurate as the requirements of the work demand.

Such simplification can be effected by the use of MacLaurin's or Taylor's series. For example, in the present case the expression for the area of the segment is evidently

$$A = r^2\theta - r^2 \sin\theta \cos\theta$$

in which

$$\theta = \sin^{-1}\frac{\sqrt{2rh - h^2}}{r}$$

$$\sin\theta = \frac{\sqrt{2rh - h^2}}{r} \text{ and } \cos\theta = \frac{r - h}{r}$$

Hence the expression becomes

$$A = r^2 \sin^{-1}\frac{\sqrt{2rh - h^2}}{r} - (r - h)\sqrt{2rh - h^2}$$

The anti-trigonometric term here is difficult to evaluate. However, this term can be expanded in terms of h and r by the use of MacLaurin's series, a discussion of which can be found in any standard textbook on the differential calculus and a brief reference to which appears on pages 1148-1149 of the American Civil Engineer's Pocket Book. (Second edition).

Briefly, MacLaurin's series is a device whereby a function may be evaluated in terms of its argument and the known value of itself and its derivatives at some given point. Its usefulness lies in the fact that by means of it any expression containing an awkward trigonometric, anti-trigonometric, logarithmic, or exponential (that is, any transcendental) term can be transformed into a new expression containing only simple algebraic terms. In general it is possible to regulate the character of the resultant expression; that is, its form can be chosen so as to be in accord with the method of computation to be used.

When it is considered how frequently in engineering, especially in water-power investigations (surge tank, penstock, etc.) complex transcendental expressions are met with the usefulness of this method will be appreciated. Many such involved expressions which, though correct, have had to be discarded in favor of less accurate but simpler expressions, because of the impossibility of making use of them in their existing cumbersome form can, by the use of MacLaurin's (or Taylor's) series, be transformed into practicable shape.

Reverting to the present case we have, letting

$$\frac{\sqrt{2rh - h^2}}{r} = x,$$

$$\sin^{-1}\frac{\sqrt{2rh - h^2}}{r} = \sin^{-1} x$$

which, expanded by MacLaurin's series, becomes

$$\sin^{-1} x = x + \frac{x^3}{6} + \frac{3x^5}{40} + \frac{5x^7}{112} + \cdots$$

Substituting this value of $\sin^{-1} x$, and for x its value $\frac{\sqrt{2rh - h^2}}{r}$ in the original expression for the area of the segment, we obtain

$$A = h(2rh - h^2)^{\frac{1}{2}} + \frac{(2rh - h^2)^{\frac{3}{2}}}{6r} + \frac{3(2rh - h^2)^{\frac{5}{2}}}{40r^3} + \frac{5(2rh - h^2)^{\frac{7}{2}}}{112r^5} + \cdots$$

This expression can be still further simplified by expanding the terms $(2rh - h^2)^{\frac{1}{2}}$, $(2rh - h^2)^{\frac{3}{2}}$, etc., so that we obtain finally:

$$A = r^2\left[\frac{4.2^{\frac{1}{2}}}{3}\left(\frac{h}{r}\right)^{\frac{3}{2}} - \frac{2^{\frac{1}{2}}}{5}\left(\frac{h}{r}\right)^{\frac{5}{2}} - \frac{2^{\frac{1}{2}}}{56}\left(\frac{h}{r}\right)^{\frac{7}{2}} - \cdots . \text{ etc.}\right]$$

This expression is simple in form and convenient for either slide-rule or logarithmic computation. It is a simple power series of h/r.

Testing this expression as to its agreement with the values of the table, we have for $h/r = \frac{1}{2}$,

$$A = r^2\left[\frac{2}{3} - \frac{1}{20} - \frac{1}{448}\right] = 0.6144r^2$$

which is only 0.03% in error.

For the extreme case of the semicircular segment, that is, $h/r = 1$, we have

$$A = r^2 \cdot 2\left[\frac{4}{3} - \frac{1}{5} - \frac{1}{56}\right] = 1.578r^2$$

which is 0.6% in error.

Closer agreement could have been obtained by adding a fourth term to the expansion, in fact any desired degree of accuracy can be arrived at in this way. All terms beyond the first two are very small as compared to the total value so that these terms can always be computed by slide-rule with a sufficient degree of accuracy. For $h/r < \frac{1}{4}$ only the first two need be used.

Mathematical handbooks, as well as engineering handbooks, give the expansions by MacLaurin's series of the more common expressions, such as sin x, log x, arc sin x, e^x, etc. In making expansions by MacLaurin's series it is of course necessary to choose such a form as will yield precise results within a few terms. The resultant expression can always be tested as to its correctness by noting its agreement with known terminal values (in this case $h/r = 0$ and $h/r = 1$).

Brooklyn. LEOPOLD PISTNER.

Give Bidders Complete Information When Advertising Contracts

Sir—On page 91 of your Searchlight Section of Sept. 6 appears an advertisement for the proposals of contractors on a bridge in Columbus, Ohio. We feel like calling attention to this advertisement. You will note that this states the length of the bridge and its width. It gives enough information about the design and the quantity of material required so that the contractor would know without sending for the plans whether or not it is within his capacity.

This is a very sharp contrast to a great majority of advertisements, particularly on Government work, which often give scarcely any idea of the magnitude of the work involved. We believe that suitable contractors are much more apt to investigate such work and become interested than would be the case where this information is not given. WILLIAM H. ADAMS,

Adams & Cummins, Consulting Engineers.

Detroit, Mich.

Objects to Extra Work Payment Clause in Miami Specifications

Sir—The "extra work" clause in the specifications of the Miami Conservancy District of Ohio, A. E. Morgan, chief engineer, is an excellently worded piece of work. There is one point to which exception can be taken, as follows: The "Conservancy District" takes for its use and benefit the following expenditures of the contractor, without pay: (1) Overhead charges, (2) general superintendence, (3) general expenses, (4) contingencies, (5) depreciation of, wear and tear upon plant, (6) maintenance of contractor's camp, except in case such camp is maintained primarily for extra work.

This discussion is based on the assumption that the 10% or 15% extra paid to the contractor is paid for the benefit derived by the owner from the use of the contractor's personal time and his business, engineering and executive abilities, knowledge and experience, to organize a construction force, to buy materials; through the use of his financial credit and capital, and his being the agency through which the desired work is constructed. The existence of a contract between the parties is conclusive evidence that these are the things which the owner or engineer desires from the contractor and for which the latter is paid. Items 1 to 6 are outside this range of activity fully as much as is the manual labor itself entering into the extra work.

Engineers who, as contractors, have made expenditures under these five items, and by accurate bookkeeping have charged to the extra work its proper expense, will realize that the small residue left of the 10% or 15% remuneration may not be an adequate payment for undertaking the extra work. Why should an engineer saddle upon a contractor the unknown and unlimited "contingencies?" Why should an engineer take and use and wear out a contractor's plant free of cost? Let him pay in an open and above-board manner for services rendered as such, and not make a contractor's pay a speculation as to whether the 10% or 15% will be an actual loss or an adequate remuneration for all the contractor's services.

The elimination of all possible uncertainty of expense to a contractor will redound to the benefit of the owner by a lowering of contract prices. Many a bid contains prices raised to cover the unknown charges which experience has taught contractors will ensue from the otherwise unpaid expense of doing extra work.

It is clauses like the one in question which cause some contractors to feel that the engineer is legitimate prey to be overcome by any and all means. It is not good business for an engineer to write a code of ethics and pose as an altruistic judge between owner and contractor, when he voluntarily becomes the owner's servant and writes into a contract a clause which throws concealed and variable charges upon the contractor.

Chicago. VICTOR WINDETT.

Macadam Roads in the War Zone

Sir—Like others, I was much interested in the article of William J. Weir on war roads, appearing in your issue of Sept. 13. Also, I have been interested in the correspondence of the concrete propagandists appearing in subsequent issues; particularly their panic at the thought that someone should be found to say a good word for macadam.

As the author has pointed out, the war road must be capable of being built quickly and possibly under the conditions of traffic, and it must be maintained under traffic; the availability of local materials is important; and, lastly, the temporary use, incident to war, favors road types of low first cost. The problem is to secure and to maintain a usable road as quickly and as cheaply as possible.

If the engineer corps were wise enough to know where a battle would be fought a year in advance, and if they

could be assured that the battle would continue and remain in one locality through a term of years, then it would be possible to lay some of the more expensive road types with assurance that the money would be well invested.

CHARLES B. BURDICK,
Of Alvord & Burdick, Engineers.
Chicago.

Sir—To the choice, by French engineers, of macadam for their network of roads, you refer in your editorial on William J. Weir's article as a "reversion" to an early type—a reversion necessitated by war conditions or necessitated when the roads were planned originally by a possibility of war. Rather than a "reversion," is it not the "persistence" of the type in its proper place?

The friends of macadam among road engineers—and from the prevalence of macadam throughout the country it seems their number is legion—will draw two conclusions from Mr. Weir's article, and the lesson should be impressed on all road builders: First, the "repairability" of macadam; it can be repaired, and well repaired, for Mr. Weir found the heaviest traveled roads "to all purposes as good as new." Second, the choice of this type made possible the comprehensive network that French engineers felt called upon to provide, and wisely did provide, in order that, wherever the clash came, not only one road would be found, but that "between two points several routes may be selected." Mr. Weir's graphic description makes the necessity for several routes very apparent.

And French engineers did choose macadam; they did not revert to it, but persisted in it, and to such an extent that "outside of villages and cities none of our so-called permanent types was encountered." How far this choice was dictated by the necessities of a probable war only the French engineers can tell, but that feature of the road problem—supplying as much mileage as possible—is presented to our engineers as well as to those of France, less for actual military operations, let us hope, than, in much greater degree, to develop the productive capacity of the land.

The actual cost of this maintenance, not in total expenditures under these abnormal conditions, but in cubic yards of materials and days of labor, would throw considerable light on costs per ton-mile, and I wish to express the hope that such figures can be obtained. Doubtless, the macadam roads of France have made good in peace times and when we learn from Mr. Weir that under the extraordinary conditions which he so ably describes they are still repairable, his conclusion that the French road system planned for just the present conditions has made good is fully warranted.

R. W. SCHERER,
Secretary, Wisconsin Crushed Stone Association.
Milwaukee.

Iron Pile Survives Long Submergence

Sir—In *Engineering News-Record* of Oct. 18, p. 759, there is a description of an iron pile that survived a quarter of a century submerged. The article said incidentally that the pile, "although neglected for years in a tropical climate, was remarkably free from corrosion when removed."

The writer has observed during many years' experience in tropical climates that iron and steel, when not in contact with the earth, remain remarkably free from corrosion. This is especially so in the Amazon Valley. On the Madeira-Mamore Railroad it was noted that the rails (probably iron), manufactured in Belgium in the early 60's of the past century, as well as machinery and locomotives, were remarkably free from corrosion even where overgrown with vines and brush after a period of more than forty years. The rails still showed the furnace scale on the web. Some rails that were lying on the rock bottom of the river, submerged half of the year, and exposed to the air the other half, showed very little corrosion.

HARVEY C. MILLER,
Chief Engineer, American International Railways Corporation.
Newark, N. J.

"Best Buy" in Pavements

Sir—Referring to the discussion in your columns as to who shall decide what materials to use in street paving: In Indiana the Board of Public Works, acting presumably, but not necessarily, under the advice of the engineer, makes choice of material, but this decision may be overturned by petition of the majority of the property owners residing on the street. This gives opportunity for fine work on the part of the gentlemanly salesmen for the various materials and personal solicitation is the order of the day (and night).

Signatures must be dated, giving also the hour and minute, and the last one "before the polls close" is the one that counts. A recent letting is typical of the way it works. A certain property owner on Apr. 8 at 8:35 p.m. signed for brick; on Apr. 12 at 1:25 p.m. he signed for asphalt; Apr. 15 at 9 a.m. for concrete and on Apr. 17 at 10:15 p.m. he obligingly got out of bed to sign again for asphalt before the close of the period.

In like manner nearly all the property owners signed from two to four petitions for different materials on this same street. As can be seen readily, this procedure secures to the citizen the privilege of changing his mind early and often, whether or not the final result is good for the street.

F. R. C.

Sir—I have read with interest both the article on page 592 of your issue of Sept. 27, and the comments by H. F. Hopkins of Pittsburgh, on page 754 of the Oct. 18 number, relating to the question of the proper method of selecting type of paving. It appears to me that there is a middle ground between the main ideas presented in these two articles, one which I have held as a personal opinion for a number of years and have seen tried in a practical way.

It is quite evident, since in a large number of our American cities the cost of the pavement is charged directly to the property owners, that they should have some voice in the selection of the material to be used. On the other hand, since in a large portion of our American cities the first cost of intersections and the whole cost of repairs and maintenance are borne by the city, there is sufficient cause for the city to be represented properly in choosing the type of pavement.

The plan which I have in mind, suggested by the writer at Beloit, Wis., sometime in 1914 or 1915, is simply this: Have the city officials, through their engineer or any competent engineering group, adopt de-

tailed plans and specifications covering a goodly number of the more standardized types of paving, and advertise for bids at one letting, on all of the types. Of course, there may be cases in which traffic conditions, value of abutting property, future development, grade of proposed improvements, etc., will eliminate for certain streets some of the paving types. However, it is my opinion that in the great majority of cases there is always a choice among several standardized types of pavements, any one of which will fill the needs if properly constructed under the right plans and specifications.

After the bids have been received on those types which, insofar as the engineering profession can predict, will prove satisfactory, the property owners should have the right to choose which type of pavement shall be used, or at least have a voice in the selection.

Such a plan as this will tend to standardize our paving specifications, will eliminate largely the opportunities for coöperative bidding on the part of the contractors, will do away with enormous expenditures on the part of paving material manufacturers, often spent in promotion, and last, but of most importance, will create real competition.

The low prices at Beloit have been explained by many as being due to various causes, but in most cases these explanations have been prompted by prejudiced viewpoints or lack of careful study of the history of this whole paving letting. The real cause of the great saving is quite evident, since it was the writer's idea in suggesting this plan to create this open competition not among the contractors bidding upon the work, but among the paving material men furnishing the prices to the contractors. The fact that this suggested plan predicted large savings—which were actually made—because of the fact that the various paving types would be brought into competition rather than the contractors bidding on these types, is strong evidence that this is the true cause of the low prices which were received at the time of the letting.

Such a plan as suggested eliminates, I believe, a great many of the questionable features of our present day practice in promoting, advertising and awarding the contracts for our modern pavements.

G. R. BASCOM,
Municipal and Sanitary Engineer.

Madison, Wis.

Mr. Bascom incloses a letter from one of the contractors in close touch with the Beloit work, A. E. Ashbrook, representing the Barrett Manufacturing Co., of Chicago. The letter says, in part: "The city council of Beloit had expected to receive bids on sheet asphalt pavement alone and were advised that the cost would range from $1.85 to $1.90 per sq.yd., which is, perhaps, a fair average for that type of construction in this state. After having followed your suggestions in receiving bids on several different types of pavement, the prices were greatly reduced, as is shown by the tabulation of the bids received, and as illustrated by the fact that bids for sheet asphalt pavement on standard specifications were received as low as $1.27 per square yard.

"From a careful study of the tabulation of the bids and the quantities as awarded, I have made the following estimate, which I believe is conservative, to represent the saving to the City of Beloit which was affected by your service."

52,650 sq yd. sheet asphalt at 53c. reduction	$27,904
50,300 sq yd. asphaltic concrete at 53c. reduction	26,659
25,000 sq yd. brick, no material reduction	
28,500 cu yd. excavation at 10c. reduction	2,850
74,000 lineal ft. of curb and gutter at 20c. reduction	14,800
Total	$72,213

What Is a "Consulting Engineer?"

Sir—There has been considerable discussion of late, both in these columns and in the technical press in general, regarding the use of the term "consulting engineer," but so far no definite conclusions have been drawn and no ethical measures have been proposed for settling the points in contention.

It is true undoubtedly that there should be some term to differentiate the engineer who maintains an office for individual practice from the engineer who is employed regularly by some corporation or manufacturer. But the fact that an engineer has an individual practice does not mean necessarily that he is a consulting engineer in the true sense of the term. It would appear that the word "consulting" should be applied only to an engineer retained by a client to assist, advise and consult with the engineer in charge. This being the case, an engineer may be consulting on one job, designing on another and superintending on still another, or he may be consulting this month and simply directing the next month.

Surely, some other term is necessary which would be applicable to the ordinary individual practitioner, or else some descriptive name should be prefixed to the engineer who is employed regularly by one client and who is not in a position to act for other clients.

The writer feels that the engineering press and societies should take up this matter and lay down definite rules for the guidance of engineers. No doubt the majority would gladly welcome a code of this kind, and the others would come gradually to accept the recognized standards.

We can never expect to secure the recognition deserved by the engineering profession as long as such a variety of terminology is found in the press and in common usage. If engineering is merely a trade we have nothing to say, but most of us feel that it is a profession of the highest order and should rank with law and medicine, and as such it should have the same prestige, the same recognition in the courts and the same honor and respect from the layman. To secure that recognition we should work harmoniously, and if this is to be done the profession needs a code of procedure or guide of some kind. Who but engineers themselves are to blame for the very unsatisfactory state of affairs existing with regard to their professional status, and who but themselves will or can raise the standard?

Johnson City, Tenn. D. R. SHEARER.

Curb Radius at Grand Forks, N. D.

The City of Grand Forks, N. D., according to J. J. Smith, city engineer, is using curbs having a 30-ft. radius at street intersections and 10 ft. at alley intersections. This practice is followed in a district where the main thoroughfares are paved for a width of 28 ft. and the cross streets for a width of 20 feet.

HINTS FOR THE CONTRACTOR

DETAILS WHICH SAVE TIME AND LABOR ON CONSTRUCTION WORK

Extra Length of Pipe Reduces Fitting in Mixer Supply Line

By Harlan H. Edwards
Danville, Ill.

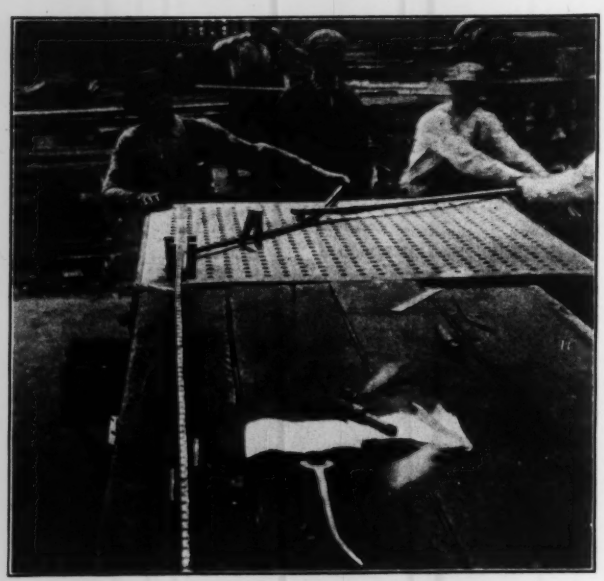
A SAVING of labor in reducing the number of times the hose has to be changed from one T in the water supply line to another, in handling a mixer on concrete road work is effected without using an unusual length of expensive hose by fitting a swing joint and one or two lengths of pipe to the T in the water line. A nipple and an L are screwed into the T in use on the water line. Into the elbow is fitted a length or two of pipe, at the end of which the hose to the mixer is attached.

If the length of hose used were such that the Ts on the main line could be spaced 160 ft. apart, by using a 20-ft. length of pipe, it would be possible to place the Ts 200 ft. apart, thus reducing by nearly ⅓ the number of changes required in moving a mile. Of course, the length of pipe is turned from the T toward the mixer, and as the latter moves down the road past the T the pipe is flopped over and laid in the other direction.

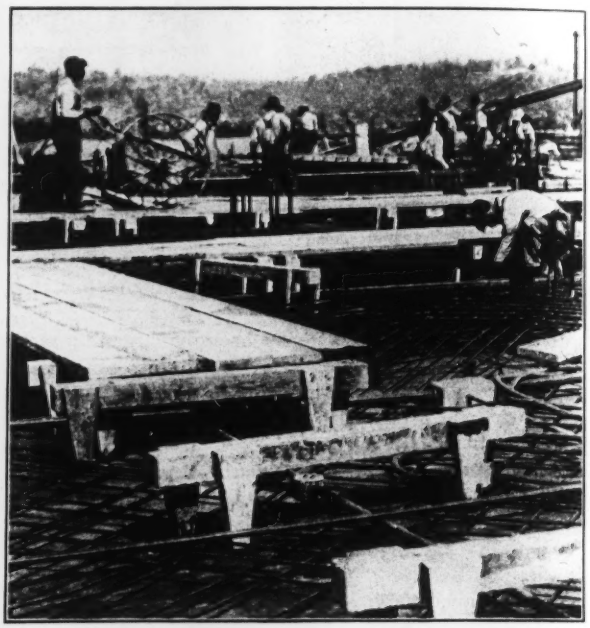
The method is used by Carl Nelson, superintendent for J. C. Poll on a road contract near Danville, Illinois.

Bar-Bender Plate and Staggered Legs on Horses Expedite Concrete Work

A PUNCHED-STEEL plate used as a working table expedites the bending of steel reinforcing bars for the Union Switch and Signal Co. building at Pittsburgh, Penn. The plate permits ready adjustment of the pins at points where the bars are to be bent. The bender is a long handle, having at one end a 6-in. pin used as a pivot, which fits into any of the holes in the plate. Adjacent to the pin is a lug which engages the bar as the handle is swung round across the plate.



REINFORCING BARS BENT ON A PERFORATED STEEL PLATE



CONSTRUCTION OF RUNWAY HORSES FACILITATES PLACING AND REMOVAL

Runways for concrete carts on the same work are supported on wooden horses which have the legs staggered and pointed, as shown in the view. This facilitates placing the horses clear of the diagonal reinforcing bars. The tapered legs make it easy to remove the horses from the concrete.

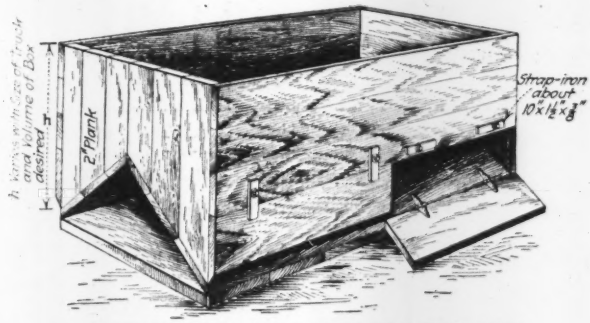
The building is being constructed by Stone & Webster, of Boston.

Hopper-Bottom Truck Bodies Used for Rapid Unloading

By Job R. Rogers
Holley, N. Y.

CONTRACTORS who contemplate the use of removable hopper-bottom truck bodies, to secure rapid unloading of loose materials and ability to employ the truck on various services, will be interested in the side-dump boxes adopted by Wing and Munger, contractors for resurfacing Part 2 of New York State Road 387.

The scheme is shown in the accompanying sketch. One of the good points of this box is the bottom-hinged side door which falls down as soon as the catch button is released, and serves as an apron to throw the material clear of the wheels. Each side has a divided door, so



HOPPER-BOTTOM BODY IS EASILY REMOVED

that quadruple control of the dumping is secured. The box ends are solid and with the inverted V-bottom make possible a rigid unit that can be easily put on and taken off the truck.

Pile Excavation on One Side of Trench So Mixer Can Spout to Forms

By L. E. Burridge
Ideal Concrete Machinery Co., Cincinnati

IN REPLACING an old brick sewer in Cincinnati with a concrete box sewer, J. J. Foley, the contractor, piled all the material excavated, to uncover the old sewer, on one side of the trench, forming an embankment high enough to enable the portable Cincinnatus paving mixer employed to spout concrete to all parts of the new sewer section.

The old brick arch is demolished down to the springing line, the old sewer lined with concrete, and the top section of the new 15-ft. box sewer constructed on top of this foundation. On account of the width of the excavation, the concrete could not have been spouted to the top of the new sewer if the spoil had not been piled on one side to as great a height as possible. The excavating was done by steam shovel. The photograph shows the mixer at work on the reconstruction of the lower part of the old sewer.

HIGH BANK ENABLES PAVING MIXER TO SPOUT INTO FORMS

Deliver Stone via Cross Streets to Industrial Cars on Subgrade

IN CARRYING out a concrete paving contract at Elizabeth, N. J., J. B. Bentley avoids driving loaded wagons over the subgrade by the simple expedient of dumping all rock, sand and cement in the cross streets. The material is unloaded in ½-yd. Koppel cars, and carried to the mixer on an industrial railway of 18-in. gage. Six cars supply the material as fast as needed. They only work part time, as the "railroad crew" also handles and places all the reinforcing.

INDUSTRIAL TRACK AVOIDS RUTTING SUBGRADE—SIX CARS SUPPLY MIXER

Advertising Engineering Education

In the September issue of "Engineering Education," the bulletin of the Society for the Promotion of Engineering Education, it is asserted that many young men would attend institutions of higher learning, and especially engineering schools, if these schools were brought to their attention in a concrete and concise way. Many young men in high schools have no opportunity of becoming familiar with the aims and objects of engineering schools, since most of their instructors, with the possible exception of those who teach manual training and physics, are graduates of colleges of liberal arts and have no conception of the engineering profession. At this time of rapid development in engineering education, it seems especially desirable that the need for engineers should be brought to the attention of the young man by means of the daily papers and the magazines with which he comes in contact.

NEWS OF THE WEEK

CURRENT EVENTS IN THE CIVIL ENGINEERING AND CONTRACTING FIELDS

Rea, Willard and Elliott To Urge Freight Rate Advance

The entire railroad situation will be placed before the Interstate Commerce Commission by the presidents of the big carriers in the Eastern territory, beginning Nov. 5. It will be remembered that representatives of the carriers appeared before the commission several weeks ago, asking for sixty days' time in which to fully present their case, claiming then that their incomes for September and October would show a greater loss than any other month of the year. Samuel Rea, Daniel Willard and Howard Elliott, of the Railroad War Board; Alfred H. Smith, of the New York Central, James H. Hustis, of the Boston & Maine, and Frederick K. Underwood, of the Erie, will make a plea for the railroads based on the necessity of maintaining their properties and bearing the extraordinary cost of moving more traffic. Messrs. Elliott and Hustis will deal with the New England situation, and Mr. Rea, president of the Pennsylvania R.R., will make the chief argument for the trunk lines.

Among the facts which will be presented to the commission will be a statement that the net incomes of the Eastern roads for the first nine months of the year shows a decline of $57,000,000, as compared with 1915, despite the fact that the great increase in traffic produced $124,000,000 more gross revenue. Furthermore, there has been a decline in the market value of railroad stocks and bonds, since America was drawn into the war, which amounts to $3,000,000,000, accompanied by an utter vanishing of the market for new railroad stocks.

Chicago Office for Road Regiment

A Western recruiting office was opened Oct. 31 to accept enlistments in the new highway construction regiment, the Twenty-Third, specially noted in the *Engineering News-Record*, Oct. 4 and Oct. 25. Lieut. J. T. Patterson, formerly assistant engineer on valuation of the Chicago & Northwestern Ry. Co., has been detailed to the work and afforded office space at the rooms of the American Association of Engineers, 29 South La Salle Street.

Santa Fe Tries Draftswomen

The department of engineering and construction of the Atchison, Topeka & Santa Fe Ry. has selected twelve women to take a six months' intensive training. Those selected have been through college or normal school, and will receive the same training as men who are working at the same problems. The particular work is the drawing of plans for yards, which will include the location of switches, bridges and signals, and the learning of the details of track layout. S. E. Rice, who is assistant general manager of the department, says that he has always felt that women could do this type of work and now that so many young men have been drafted he is glad of the opportunity to prove that he is correct.

Viaduct Leading to Grand Central Station in New York Begun

The viaduct on Park Ave. leading to the 42nd St. entrance of the Grand Central Terminal in New York City was begun with formal ceremonies on Nov. 1. This approach is a novel structure in that it will carry vehicular traffic from the street to an upper-level roadway around the station. This roadway is a part of the station structure and is on the second-story level at 42nd St., but due to the change in street elevation reaches grade at 45th St. When the viaduct is completed a new and much-needed north and south vehicular thoroughfare will relieve congestion of mid-Manhattan and the great bulk of the station will no longer be a barrier across the city.

Army Cantonment Heating Plants Nearing Completion

The installation of heating plants at the National Army cantonments is progressing as rapidly as labor and the delivery of materials will permit. The probabilities are now that all plants will have been installed by Nov. 1. Four camps are to be steam-heated throughout with the exception of a few small units using stoves, which units constitute less than 10% of the total amount of heating required. These four cantonments are those at Ayer, Mass., Battle Creek, Mich., Rockford, Ill., and Ft. Riley, Kan. The remaining twelve cantonments have steam heat in hospitals and officers' quarters, but the barracks are heated by large hot-air furnaces, as are the mess halls.

New Freight Terminal at Chicago

A large freight terminal is to be built at Chicago by the Chicago, Burlington & Quincy R.R., as part of the extensive revision of the railway terminal system consequent upon the construction of the new Union Station. It will be located near Canal St., between Harrison and Polk Sts. Bids are now asked for the grading and for the open caissons or wells for the foundation piers. W. T. Krausch is engineer of buildings and has the matter in charge.

Skilled Men Needed by New Quarry Regiment, 28th Engineers

The Corps of Engineers, U. S. Army, according to an official communication sent to *Engineering News-Record* this week by Major O. B. Perry, Engineer Officers' Reserve Corps, has been authorized to raise by voluntary enlistment a special quarry regiment to consist of six companies of 250 men each and to be known as the 28th Engineers, National Army. This regiment is now being recruited and the first two companies are in training at Camp Meade, Maryland.

This regiment is to be made up entirely of picked men from the various quarries of the country. All trades and occupations in the quarry business will be represented. Each company will have a sufficient number of skilled men to operate a separate quarry plant and will be equipped with a complete rock-crushing and screening plant capable of producing 1000 tons of crushed rock per day. Churn and air drilling outfits will be provided and the equipment will include steam shovels, locomotive cranes, steam locomotives, cars and other standard quarrying machinery. Only men who have had experience in the handling of such equipment and those who have worked in and about quarries will be enlisted for this service.

The commanding officer will be a regular army engineer officer; the other officers of the regiment will be largely drawn from the engineers and quarry superintendents who have volunteered their services, have been given the necessary military training at the officers' training camps and are now commissioned in the Engineer Officers' Reserve Corps. The 28th Engineers offers a great opportunity for the quarrymen of this country to show their skill and courage. The success of the American army operations in France is dependent on the roads and railroads. The amount of crushed stone required is enormous. It is the duty of the quarrymen of the country to meet these requirements.

Pacific Logging Congress Held in Seattle

The ninth session of the Pacific Logging Congress convened for two days in Seattle, Oct. 18 and 19. Delegates from California, Idaho, Montana, Oregon and British Columbia were present. Among the papers presented were: "Gasoline Locomotives," by J. E. Buckingham; "Logging Railroad Construction" (committee report), James O'Hearne, chairman; "Logging Engineering and University Training."

H. E. Breed Heads American Road-Builders' Association

At its annual meeting, held at the Automobile Club, New York City, Nov. 2, the American Road-Builders' Association elected as its new president H. Eltinge Breed, first deputy commissioner of the New York State Highway Department. The afternoon session drew only a small attendance, about 30. The matter of the Priority Board's embargo on open-top cars for the transportation of road material (see *Engineering News-Record*, Nov. 1, p. 855) came up for discussion, but the decision was made to take no action. Later in the day, however, the association passed a resolution by Prof. A. H. Blanchard, endorsing the road-building resolution passed at the recent War Convention of American Business held at Atlantic City (see *Engineering New-Record*, Sept. 27, p. 62).

In the evening the association held its "get-together" dinner, at which Maj. I. C. Moller told of the work of recruiting the new road-building regiment, the Twenty-Third Engineers, in which this journal has played such an important part. Major Moller made the point that the American troops will depend largely upon powerful, up-to-date construction plant—to such an extent, in fact, that it is estimated that the 10,000 men of the American unit will be able to accomplish what 40,000 British troops have done with comparatively little road-building mechanical equipment.

"The prospect is," said Major Moller, "that the work of the Twenty-third Engineers will be the maintenance of about 2000 miles of road, in addition to such new routes as will be constructed." He explained that the present needs of the Twenty-third are roller runners, stone crushers, drill runners and traction-engine operators.

In addition to Mr. Breed, the other new officers of the association are: Lieut.-Col. W. W. Crosby, consulting engineer, Baltimore, Md., first vice president; Austin B. Fletcher, state highway engineer of California, second vice president; Arthur H. Blanchard, professor of highway engineering, Columbia University, third vice president; E. L. Powers, editor *Good Roads*, secretary and treasurer.

The following six directors were elected: Maj. H. L. Bowlby, William H. Connell, Joseph W. Hunter, Nelson P. Lewis, H. G. Shirley and William R. Smith.

Dedicate St. Louis-Belleville Road

The new concrete boulevard which has been constructed at a cost of $1,000,000 and which lies entirely inside the city limits of Belleville, Ill., but which furnishes the link connecting the city of St. Louis with that town, was formally opened to traffic on Nov. 6. The boulevard is said to be the longest stretch of concrete in any city of the United States, and has been built to relieve an abnormal condition.

Road Regiment Applicants Now Number 6000

Civil War Veteran Seeks Admission to 23rd Engineers—Lieutenant Would Give Up Commission To Join

Recruiting for the 23rd U. S. Engineers, the regiment of road builders to go to France, whose ranks *Engineering News-Record* has been assisting to fill, has been progressing at a rapid rate during the past week and more than 1200 men are now mobilized at Camp Meade, Md., with large groups joining the colors every day.

Beginning Saturday competitive company drills for prizes will begin, and Col. E. N. Johnston, U. S. A., commanding the organization, announced in Washington the past week that he has obtained the use of the rifle range at the Naval Academy, at Annapolis, for target practice for the men, and that the road-builders are about to begin learning how to shoot in the army manner under the most favorable conditions and most qualified instructors, in groups of 600 each week.

Applications to join the regiment have so far numbered about 6000. Those desiring to join should address Col. E. N. Johnston, U. S. A., 23rd U. S. Engineers, 1419 F St. Northwest, Washington, D. C.

Of the thousands of letters received at the Washington headquarters of the new road-construction regiment the following two indicate a spirit typical among the men.

"Col. E. N. Johnston, Commanding 23rd Engineers.

"Sir—I have read the statement that you are short of men and I am very anxious to go to the front. I have been foreman and superintendent of bridge work for the past 41 years, having been made a foreman by A. M. Long, master builder on the Milwaukee road in 1876; have been in active work and contracting continually since. Can calculate strains; make estimates, and have a good knowledge of planalogy. I am well used to steel, wood, and concrete work and have bridged the Mississippi three times and the Missouri four times. I am in perfect health and my father is a very active man at 96 years of age.

"My age is seventy the eighth day of last May. I served four years during the Civil War in Company F, 9th Regiment, Indiana Volunteers, and one year in Company A, 29th Regiment, Indiana Volunteers. Was wounded and captured at Chickamauga and prisoner eight months. Can furnish reference from any contractor on the coast or many Chicago firms and roads; also the Phoenix Bridge Co., Phoenixville, Penn.; the Pencoyd Bridge Co., Pencoyd, Penn.; Edgemoor Bridge Co., Wilmington, Del. I can start on the first train and pass any physical examination here or there. Height, 5 ft. 10 in.; weight, 160 lb. Never have been sick and worked on Copper River and Northwestern from Cordova to Kennecott, Alaska, during the construction of that Guggenheim line for three years. Also worked on the Harry Meggs road in Peru, 38 years ago, and on Southern Pacific line in Guatemala 31 years ago, in first instance for V. G. Bogue and second instance for Arthur Brown, superintendent B. & B. S. P. road at Oakland, Calif. Will gladly go in any capacity. My pension certificate is No. 1,157,585. Act of May 11, 1912, last increase is to $25 per month. I expect ten years of good solid work yet.

Very respectfully,
(Signed) HENRY E. ELLIOTT.
Long Beach, Calif.

The second communication, from a lieutenant in the Engineer Officers' Reserve Corps, follows:

"Chief of Engineers,

"I received lieutenant's commission, Engineer Reserve, in July and have not been called. Wish to resign commission and enlist in the 23rd Engineers, National Army. Am in road-construction work at present. If this transfer is possible what procedure do I follow?

ROBERT L. RYAN.
Santa Barbara, Calif.

Seattle's Water-Supply Planning To Be Completed

Although actual work on extensions to Seattle's Cedar River water system may not begin for a year on account of the condition of the bond market and the fear that an attempt to float the $3,700,000 worth of bonds might not result favorably for the city, plans and specifications for the improvement will be completed under the direction of L. B. Youngs, superintendent of the Water Department and sent to the Board of Public Works for approval. The plans in course of preparation provide for the development of Swan Lake as a storage reservoir, the construction of a water-supply tunnel which will be concrete lined from the lake to Molasses Creek, the construction of a third pipe line from the end of the tunnel to the City of Seattle, the construction of high and low-pressure reservoirs in West Seattle, and the enlargement of the reservoir.

Seattle Will Expend Large Sum on Street Improvements

The Engineering Department of the City of Seattle, Wash., A. H. Dimock, city engineer, has been called on to prepare plans and submit estimates for street improvements calling for the expenditure of considerably more than $1,000,000. In addition, the Engineering Department has been directed to make and submit a plan for separation of grades on tide lands, now developing rapidly as industrial districts. This work will require a year, and will call for the expenditure of several million dollars by railroad corporations.

Candidates Named for New England Water-Works Association

The nominating committee of the New England Water-Works Association has selected the following candidates for office during the year 1918:

For president, Carleton E. Davis, chief, Bureau of Water, Philadelphia, Pa.; for vice presidents, Samuel E. Killam, superintendent pipe lines and reservoirs, Metropolitan Water-Works, Boston, Mass.; Henry V. Macksey, superintendent of public works, Woburn, Mass.; Frank A. Barbour, consulting hydraulic and sanitary engineer, Boston; Percy R. Sanders, superintendent of water-works, Concord, N. H.; Thomas McKenzie, superintendent water-works, Westerly, R. I., and Henry R. Buck, consulting engineer, Hartford, Conn.; for secretary, Willard Kent, civil engineer, Narragansett Pier, R. I.; for editor, Henry A. Symonds, hydraulic engineer, Boston.

The committee has also chosen as candidates for the executive committee: Frank J. Gifford, superintendent of water-works, Dedham, Mass.; A. R. Hathaway, water registrar, Springfield, Mass., and H. T. Sparks, superintendent of water-works, Brewer, Me. For the finance committee, the selections are: George A. Carpenter, city engineer, Pawtucket, R. I.; Edwin L. Pride, public accountant, Boston; Bertram Brewer, superintendent sewers and water-works, Waltham, Mass.

The nominating committee, whose report has just been sent out to the membership, consisted of R. C. P. Coggeshall, chairman, George A. Stacy, W. T. Sedgewick, Frank E. Hall and F. F. Forbes.

Faculty Changes at Massachusetts Tech Are Announced

So great has been the demand by the Government and by industrial corporations for men of technical skill for the problems that are now on hand, that the Department of Electrical Engineering of the Massachusetts Institute of Technology has suffered a loss of one-third of its staff, while the mechanical and civil engineering, and the chemistry and naval architectural faculties have sustained important losses. On the other hand, the demands for instruction have not decreased, for the registration at the institute is but slightly less than normal.

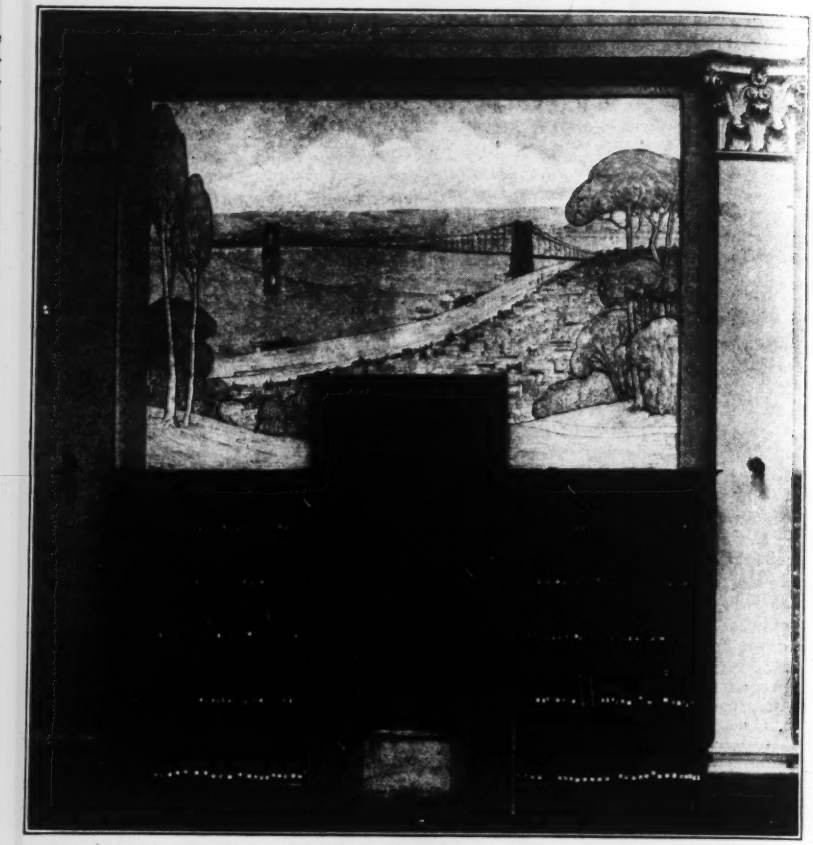
Illinois Civil-Service Examination for Railroad Engineer

An unassembled original entrance examination to provide an eligible list for the position of railroad engineer for the Illinois Public Utilities Commission will be held by the Illinois State Civil Service Commission on Nov. 24. There is one position to be filled at Springfield. The salary will range from $250 to $333.33 a month and the examination is open to all male citizens of the United States over twenty-five years old. The appointee will have entire charge of the investigation of railroad accidents, examination of dangerous crossings, inspection for approval of interlocking plants and signal circuits, investigation of railroad service complaints, and preparation of orders in connection with railroads.

The requirements consist of an education equivalent to high-school graduation with a perferably higher engineering training, and there must be experience in location, construction and maintenance of railroads and other engineering works. The applicant should be competent to make a digest of testimony, analyze it and prepare orders relating to matters connected with railways. The examination will consist of the following: Training and experience, 4; special subjects covering the abovementioned duties, 6.

Applications must be on file in Springfield before 5 p.m., Nov. 22, and no application blanks will be mailed after Nov. 19. Questions covering training and experience will be mailed to all applicants on Nov. 24, together with instructions for sending their replies to the commission. Further information and application blanks may be secured by addressing the State Civil Service Commission at Springfield, Ill.

Mural Paintings Depict Engineering Themes.



ENGINEERING COLLEGE LIBRARY OF THE UNIVERSITY OF CINCINNATI DECORATED WITH SCENES ALLEGORICAL OF ENGINEERING ACHIEVEMENT

Recently there was dedicated at the College of Engineering, University of Cincinnati, a series of mural paintings which are unusual in their theme and setting. The various panels constitute both a group of landscape paintings and an allegory of engineering achievement. A suspension bridge, a large dam, a skyscraper, a wireless station and other engineering works are presented, with appropriate backgrounds. The treatment is not literal, however, nor are the technical features obtrusive. The repetition of some conventional details unifies the series and gives it a suggestion of symbolism such as one naturally associates with mural decorations.

The paintings are the work of Frances Wiley Faig, a prominent Ohio Valley artist. Mrs. Faig's preliminary studies for the library panels were shown in the annual exhibit of the American Artists' Association in the spring of 1916. They attracted much attention at this time, and the completed paintings have drawn many visitors to the engineering college. The project was planned and money for carrying it out was raised by the senior coöperative civil engineering class of 1916. The decoration of the Library is one phase of a general movement at the institution to emphasize the broader interests of the engineer.

Merchants Will Aid in New York's Snow Removal

Street Cleaning Commissioner Fetherston Receives Promise of Trucks and Men for Emergency Work

Plans have been formulated whereby the merchants of New York City will coöperate with the Department of Street Cleaning in the removal of snow from city streets this winter. The board of directors of the Merchants' Association, at its meeting Oct. 22, ordered this action after considering a report of its committee on city conditions, submitted by John C. Eames, chairman. The report follows:

"Street Cleaning Commissioner Fetherston has informed your committee that the difficulties hitherto encountered by his department in obtaining sufficient labor for prompt removal of snow will be greatly increased during the coming season by the scarcity of the labor supply. He is of the opinion, therefore, that unless effective plans for coöperation by merchants, truckmen and railroads to give aid in snow removal can be arranged, extremely serious and protracted interruption of street traffic may occur.

DETAILS OF THE PLAN

"Your committee, in conference with the Street Cleaning Commissioner and the Motor Truck Club of America, has considered a plan for the purpose named. It is proposed that immediately following a heavy snowfall, merchants agree to suspend a certain designated class of outward-bound shipments during, say, one-half of the day for a period if necessary of two or three days; that during such time of suspension they release their trucking contractors from the obligation of moving freight and thereby permit such trucking contractors to place their trucks at the disposal of the Street Cleaning Department; that merchants and shippers whose packers and porters cannot be fully employed while the movement of freight is suspended assign such packers and shippers as can be spared to the duty of loading snow from the streets in the immediate vicinity of such merchants' premises upon the trucks so released.

"Under this plan, several hundred trucks or more, together with the necessary help for loading, can be at once employed in the removal of snow from business streets designated by the commissioner, whereas several days would necessarily elapse before all of the streets in question could be freed from snow if only the force of the Department were employed.

"Your committee wishes to have made a personal canvass of a large number of the principal houses in the wholesale grocery and dry goods commission interests with a view to presenting to them the proposed plan in proper detail and obtaining their agreement to conform to such a plan.

"The committee further wishes that after such a preliminary canvass has been made, the association communicate by circular letter and otherwise to the entire business community and urge its general adoption. The purpose of the preliminary personal canvass is to obtain in advance the support of leading merchants as a means of influencing others to the acceptance of the plan.

"It is suggested that the personal canvass might readily be made in a couple of days by the solicitors of the membership bureau."

The vote on the report was unanimous with the further recommendation that, wherever possible, snow be piled in the middle of the street.

Minnesota University Welcomes Dean John R. Allen

John Robins Allen, the new dean of the College of Engineering and Architecture, University of Minnesota, was welcomed to the state and to the university in a dinner in the Hotel Radisson, Minneapolis, on Oct. 18. The dinner brought together many Minnesota engineers and architects. Fifteen societies of engineers, architects and others were represented at the dinner, and the program included addresses by representatives of the various national societies. Professor Allen spoke of some of his experiences while at Robert College, in Constantinople, and, in a more serious vein, of his ambitions for the College of Engineering of the University of Minnesota. Professor Allen went to his Minnesota post from that of professor of mechanical engineering at the University of Michigan. He was formerly president of the American Society of Heating and Ventilating Engineers, and is the author of "Coefficient of Transmission in Cast Iron Radiation," "The Effect of Painting Radiation Surfaces," "Notes on Heating and Ventilation" and (with J. A. Bursley) "Steam Engines; Steam, Gas, Steam Turbines and Their Auxiliaries."

JOHN ROBBINS ALLEN

Port of New York Will Be Under War Control

Regulation Necessary Since 80 to 90 Per Cent. of Exports Pass Through Harbor

Irving T. Bush, head of the Bush Terminal Co., has been appointed executive head of the New York Port War Board by Secretary of War Baker, and will enter upon his new duties Nov. 7. The first step of the board will be to make a survey of all the shipping and railroad facilities centered around the New York port. All information relating to pierage, storage and terminal conditions will be collected and classified, so that the board will be in a position to direct and regulate without difficulty or delay the shipment of supplies abroad.

The plan at present being considered involves bringing under centralized Federal control of all docks, piers, terminals and storage houses on the New York and New Jersey sides, whether they are owned by city, state or privately. It is not expected that the Government will seize or commandeer facilities, but rather that an effort will be made to eliminate all interferences between private entrprises which might delay the shipment of troops and supplies for the prosecution of the war.

The conditions in New York Harbor have been aggravated not so much through a lack of resources, but more by an absence of coördination between the various shipping interests in the utilization of the present facilities of the port to their maximum extent. It is realized in many quarters that the port, even at its present development, could be made to extend its facilities by at least 25%, and that to accomplish this would mean only the elimination of useless competition. Since 80 to 90% of American exports must pass through New York Harbor, and since the transportation of soldiers and food to Europe alone requires the utilization of practically the maximum energies of the port, every obstacle in the way of an interrupted flow of supplies to Europe must be removed.

California Iron Bridge Fails After Forty Years

The Santa Clara street highway and electric-railway bridge across Coyote Creek, at San Jose, Calif., which consisted of three 53-ft. pin-connected Pratt trusses 7½ ft. deep, with 36-in. latticed floorbeams, collapsed Oct. 20. The members of the bridge were wrought iron. The bridge was designed forty years ago for a probable live load of 100 lb. per square foot.

Three loaded freight cars, whose gross weight was about 175 tons, had been stopped upon the bridge, and preliminary investigations have indicated that the first failure occurred in the floorbeams immediately beneath a loaded truck near the third point of the span immediately upon starting the train.

ENGINEERING SOCIETIES

New England Water-Works Association will hold its monthly meeting at the Boston City Club Wednesday, Nov. 14. Lunch will be served at 1 p.m., after which the Dexter Brackett Memorial Medal for the year 1916 will be presented by Desmond Fitzgerald. The remainder of the session will be given over to papers on water-works shop construction by A. E. Martin, superintendent of water-works, Springfield, Mass., and the construction of the earth dam on Phelps Brook, at Hartford, Conn., by J. H. Shaunessy, assistant engineer, Hartford Water Department.

The Society of Russian American Engineers held a meeting at the assembly room of the Merchants Association of New York Oct. 18. Leon Moiseef made an address. Other speakers of the evening were: Walter L. Ransom, chief counsel of the Public Service Commission for the First District, New York; Walter N. Polakov and Prof. Lomonosoff, the last a member of the Russian Extraordinary Mission.

The Cleveland Engineering Society has organized a section to be known as the "Iron and Steel Section," which will be subdivided as follows: Blast furnace, steel works, steam and electric, foundry practice, steel treating and welding. A meeting for the purpose of organizing this section was held Oct. 25 in the society rooms and resulted in the election of D. T. Croxton, president of the Cleveland Furnace Co., as chairman, and H. T. Harrison, chief engineer of Corrigan, McKinney & Co., as first vice chairman.

The Cornell Society of Civil Engineers of the City of New York elected the following officers at their annual meeting, held Oct. 16: President, Joseph C. Hilton, of Mason, Hilton & Co., contractors; vice president, J. H. Dickinson, manager Lidgerwood Manufacturing Co.; second vice president, Ira W. McConnell, assistant chief engineer, Stone & Webster; recording secretary, C. R. Harding, assistant consulting engineer for Southern Pacific Co.; and corresponding secretary and treasurer, Ernest A. Truran, assistant engineer with the New York Central Railroad.

PERSONAL NOTES

OGDEN DUTCHER, city engineer, Nampam, Idaho, recently resigned his position, and has been succeeded by L. R. COOK of that city.

BURTON SMITH, engineer of the Oakdale Irrigation District, Calif., has resigned, effective Jan. 1.

WILLIAM S. CONE, formerly project manager of the Salt River Irrigation project, and IRVING C. HARRIS, operating electrical engineer and inspector on the same work, have announced the formation of a partnership with the purpose of engaging in a general engineering practice under the firm name of Cone and Harris, with offices in the Hollingsworth Building, Los Angeles, Cal.

JAMES BUCKELEW, superintendent of the Camden Terminal Division and the West Jersey & Seashore R.R., has been appointed superintendent of the Maryland Division of the Philadelphia, Baltimore & Washington Ry., with headquarters at Wilmington, Del. Mr. Buckelew has been in the service of the Pennsylvania Railroad Co. since 1885.

J. A. MCCREA has been granted an indefinite leave of absence from his position as general manager of the Long Island R.R., and his position will be filled by JOHN R. SAVAGE, chief engineer.

GEORGE M. NEEL, formerly engineer and Western representative of the Klauer Manufacturing Co., Dubuque, Iowa, is now engineer in charge of the Rio Grande drainage investigation being undertaken by the state engineer of New Mexico. The work is being done under an act passed by the State Legislature, which made appropriations for the purpose of making surveys and investigations of the valley from the New Mexico-Colorado state line to the New Mexico-Texas state line, with the purpose of determining the feasibility of reclaiming and draining lands which are now unfit for agricultural purposes.

NATHAN WOHLFELD, formerly superintendent of construction with the W. C. Hedrick Construction Co., Dallas, Tex., is at present with the 17th Regiment of Railway Engineers in France.

H. S. SLOCUM, formerly engineer in charge, St. Lawrence Transmission Co., is at present resident engineer for Vielè, Blackwell & Buck on the construction of a steam power plant for the Appalachian Power Co., at Glen Lyn, Virginia.

B. B. BURNS has been appointed assistant highway engineer of Lincoln County, West Virginia.

CAPT. R. B. H. BEGG, Engineer Officers' Reserve Corps, has been granted leave of absence from his position as professor of civil engineering at Virginia Polytechnic Institute and is now with the American Expeditionary Force in France.

R. W. TRULLINGER, for the past six years engineer specialist in the Office of Experiment Stations, United States Department of Agriculture, has been commissioned first lieutenant in the Ordnance Section, Officers' Reserve Corps.

E. V. HEILMAN, formerly mechanical and electrical engineer with the Philadelphia & Reading Ry., has been elected vice president and general manager of the Lykens Valley Fuel Co., Inc., Reading, Pennsylvania.

OBITUARY

JAMES B. SMITH, contractor, Seattle, Wash., died recently at the age of 70 years. He was born in Scotland and lived in New York and Michigan before moving to Washington.

COL. HENRY MACMULLEN, a consulting engineer in New York for many years and a veteran of the Civil War, died on Oct. 30 in Jersey City, age 81. He was associated for many years with the firm of Ford, Bacon & Davis, New York.

CAPT. A. T. RICKARDS, Royal Flying Corps, was killed in action at the French front on Sept. 13. Captain Rickards was an engineer-graduate of the School of Applied Science at McGill University.

WILLIAM MURDOCH, city engineer of St. John, New Brunswick, died recently at the age of 69.

JULIAN L. WELLS died in Santo Domingo, where he was engaged in the development of tropical timber resources. Mr. Wells was graduated from the University of Virginia, and went to Mexico where he engaged in mining at the Batoplas mine—later becoming identified with the Mexican Light and Power Co. Later he was employed in the Federal service in the Hawaiian Islands.

RODERICK MCLENNAN, of Portland, Ore., prominent in that city for many years as a contractor and builder, died recently.

JOHN EDWARD SWANKER, who died Oct. 20, was in the engineering department of the Ferguson Steel and Iron Co., Buffalo, N. Y. Mr. Swanker was a graduate in civil engineering from Union University in 1887, and was connected with several large American concerns, besides being for six years general manager of the Tees Side Bridge and Engineering Works, Ltd., of Middlesbrough, England. Before going to England to help introduce American methods there Mr. Swanker was connected with the engineering department of the Hilton Bridge Construction Co., becoming its manager and engineer upon its absorption by the American Bridge Co. He was a M. Am. Soc. C. E., and one of the charter members of the Efficiency Society. While resident abroad he was a member of the British Iron & Steel Institute. Mr. Swanker was born in Schenectady, N. Y., July 4, 1865.

WILLIAM THEODORE JACOBSON, contractor, Portland, Ore., who was identified for many years with Robert Wakefield in the Portland Bridge and Building Corporation, died in that city recently. Mr. Jacobson was a veteran of the Civil War, and constructed much of the jetty and bridge work in the Northwest.

SAMUEL T. MONROE, one of the oldest civil engineers in Southern

New York, died in Binghamton, N. Y., on Sept. 23. He had charge of the construction of the Delaware & Hudson R.R. tunnel at Sanitaria Springs, which half a century ago was considered a remarkable piece of work.

ROY D. BREEN, chief engineer for the Selden-Breck Construction Co., of St. Louis, at the Aviation Camp at Fort Sill, Okla., died as a result of an accident on Oct. 11.

JOHN C. SULLIVAN, at one time assistant superintendent of the O'Rourke Engineering Construction Co., died recently in New York. He was born in Holyoke, Mass. Mr. Sullivan had charge of the construction of one of the North River tunnels of the Pennsylvania R.R., and later built one of the sections of the Ashokan Dam. At the time of his death he had a contract from the city of New York to build a sewer in West 46th St. from 7th Ave. to the Hudson River.

LT. COL. HENRY H. ROBERT, Corps of Engineers, U. S. A., died at Vancouver Barracks on Sept. 1. He was born at Centerville, Miss., in 1882, was graduated fourth in his class at West Point in 1904, and completed the course at the Army Engineering School in 1908. He was put in charge of the Dalles-Celilo Canal work for the Government, and later became War Department engineer, Southern Department, during the recent Mexican crisis. At the time of his death he was serving as lieutenant colonel of the Fourth Regiment of Engineers.

TRADE PUBLICATIONS

The Ideal Concrete Machinery Co., Cincinnati, Ohio, has issued catalog No. 33, illustrating and describing Ideal Cincinnatus batch mixers.

Pot-valve pressure pumps are described in Bulletin W-500, just published by the Worthington Pump and Machinery Corporation, 115 Broadway, New York.

The Burt Manufacturing Co., Akron, Ohio, has prepared a new and attractive 128-page catalog describing the complete line of oil filters, exhaust heads and ventilators made by this company.

The Link-Belt Co., Chicago, Ill., is sending out Folder No. 340 on sand and gravel washery at Raritan Ridge Clay Co. and Book No. 343 on Link-Belt rope tramway system, Watson type.

Winches, derricks and cableways are briefly described in Catalog A, issued by John T. Horton Co., Inc., 242 Bradhurst Ave., New York.

Ransehousen pivot lock manhole covers are described in a pamphlet received from the East Iron and Machine Co., Lima, Ohio.

The Kettle River Co., Minneapolis, Minn., has issued a catalog describing what they designate as "The New and More Economical Creosoted Wood Block Pavement" and gives reports of tests made on such pavements.

"Mack Trucking Among the Clouds" is the title of a pamphlet issued by the International Motor Co., New York, which describes the transporting of a large mirror to the top of Mt. Wilson, Calif., for the new observatory now nearing completion.

The Appleton Manufacturing Co., Batavia, Ill., has issued a new catalog illustrating and describing windmills.

The J. Edward Ogden Co., 147-149 Cedar St., New York, has issued a catalog descriptive of mechanisms for operating heavy doors for warehouses, car barns, roundhouses, etc.

The Modern Iron Works, Quincy, Ill., has a new circular showing new and improved constructions in water-works appliances.

Autotruck bodies are illustrated and described in a new catalog issued by the Peter Barrett Manufacturing Co., Navy, Johnson and Raymond Sts., Brooklyn, N. Y.

The Walter A. Zelnicker Supply Co., St. Louis, Mo., is sending out Bulletin No. 226 on second-hand equipment.

The Jennison-Wright Co., Toledo, Ohio, has issued a new catalog describing Kreolite wood block floors.

Snow oil pumps are described in Bulletin No. S-112 issued by the Worthington Pump and Machinery Corporation, 115 Broadway, New York.

The Wright Wire Co., Worcester, Mass., has issued a bulletin giving a history of the organization and a description of its work. This contains photographs of the officers and salesmen of the different branches and views of the mechanical departments. A brief history of the wire industry is included and some of the concern's products are shown.

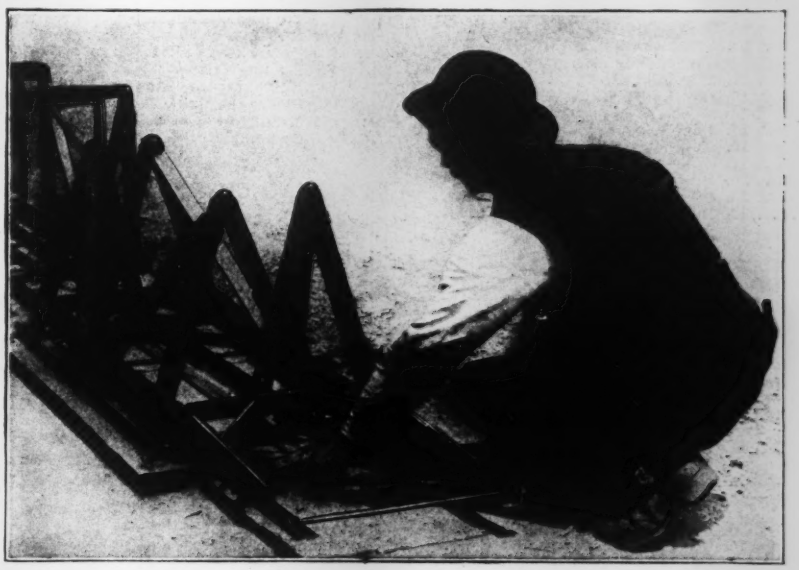
APPLIANCES AND MATERIALS

One-Man Collapsible Culvert Form

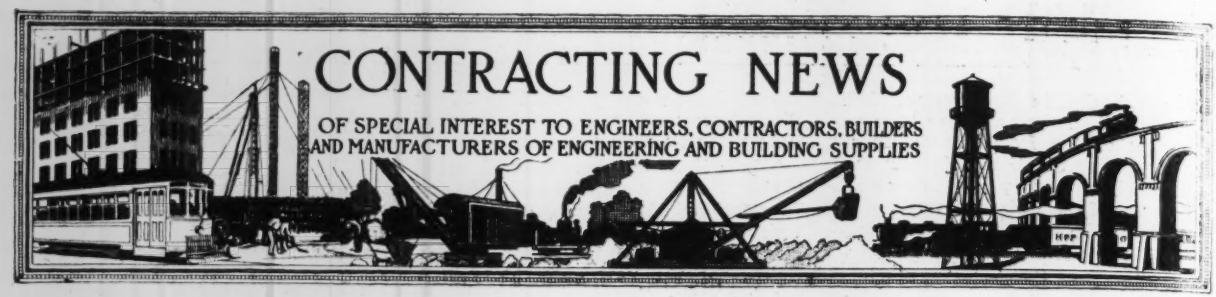
A collapsible steel frame for culverts which is also capable of being extended in height and width to make 39 different sizes, has recently been placed on the market. It has a frame built of angles and bars, and after erection this is covered with planks. In the photograph the supporting brace is lying flat and the operator has just pulled on the center bar which has drawn in the angle iron side sills—the bottom struts being made of two bars pivoted by a bolt at the center. If the planks fall when the side and top supports are removed, the last operation is deferred until the planks are removed; otherwise the sills are drawn in and the framework pulled out of the culvert.

The forms are made in two sizes covering cross-sections of from 14 x 16 to 36 x 46 in. For a 30-ft. length four sections are used spaced 4 ft. apart. If a concrete bottom is desired, the concrete is mixed stiff and supporting planks are laid on the green concrete. When building culverts too small for a man to enter, wires are attached to the cross rod and center bar in order to collapse the frame and remove it from the culvert. To keep the lumber and frames clean tar paper is laid over the forms before depositing the concrete. The manufacturers claim savings in time and money of 25 to 50% over concrete culverts built with wood frames.

The frames are manufactured by the Storms Manufacturing Co., Monadnock Building, Chicago.



PULLING CENTER ROD DRAWS IN ANGLE IRON SIDE SILLS


CONTRACTING NEWS
OF SPECIAL INTEREST TO ENGINEERS, CONTRACTORS, BUILDERS
AND MANUFACTURERS OF ENGINEERING AND BUILDING SUPPLIES

Proposals

For Proposals Advertised See Pages 48 to 51 Inclusive

WATER-WORKS

Bids Close		See Eng. News-Record
Nov. 10.	Winnipeg, Man. ..... Adv. Nov. 1 and 8.	Nov. 1
Nov. 15.	Chapleau, Ont.	Nov. 1
Nov. 16.	Winnipeg, Man.	Nov. 8
Nov. 19.	Wooster, O.	Nov. 8
Nov. 20.	Charleston, Miss.	Nov. 8
Nov. 26.	Euclid, O.	Nov. 8
Nov. 26.	Winnipeg, Man.	Nov. 8
Dec. 3.	Winnipeg, Man.	Nov. 8

SEWERS

Nov. 9.	Brooklyn, N. Y.	Nov. 1
Nov. 10.	Sioux City, Ia.	Nov. 8
Nov. 12.	Pleasantville, N. J. ..... Adv. Nov. 1.	Nov. 1
Nov. 12.	Highland Park, Mich. ...	Nov. 8
Nov. 13.	Lorain, O.	Nov. 8
Nov. 14.	Niles, O.	Nov. 1
Nov. 14.	New York, N. Y.	Nov. 8
Nov. 16.	New York, N. Y.	Nov. 8
Nov. 17.	Appleton, Wis.	Nov. 8
Nov. 19.	Brainerd, Minn.	Nov. 1
Nov. 26.	Oil City, Pa.	Nov. 1
Nov. 23.	Independence, Mo.	Nov. 8

BRIDGES

Nov. 12.	Minneapolis, Minn.	Oct. 25
Nov. 17.	Charleston, S. C.	Nov. 1
Nov. 17.	Bowling Green, Mo.	Nov. 8
Nov. 19.	Charleston, S. C. ..... Adv. Nov. 8.	Nov. 8
Dec. 4.	West Palm Beach, Fla. ...	Nov. 8

STREETS AND ROADS

Nov. 9.	Brooklyn, N. Y.	Nov. 1
Nov. 10.	Gibson, Ga.	Nov. 1
Nov. 10.	Colorado	Nov. 8
Nov. 11.	Princeton, Minn.	Nov. 8
Nov. 12.	California	Nov. 1
Nov. 12.	Lebanon, Ky.	Nov. 8
Nov. 12.	St. Paul, Minn.	Nov. 8
Nov. 12.	Pittsburgh, Pa.	Nov. 8
Nov. 13.	Prestonsburg, Ky.	Oct. 25
Nov. 14.	Minnesota	Oct. 25
Nov. 14.	Phila., Pa.	Nov. 8
Nov. 15.	Indiana	Nov. 8
Nov. 15.	Enterprise, Ala.	Nov. 8
Nov. 15.	Clarksville, Tenn.	Nov. 1
Nov. 15.	Arkansas ..... Adv. No. 8.	Nov. 8
Nov. 15.	Wingdale, N. Y. ..... Adv. Nov. 8.	Nov. 8
Nov. 16.	Cincinnati, O.	Nov. 1
Nov. 17.	Indiana	Nov. 8
Nov. 24.	Charleston, W. Va.	Nov. 8
Nov. 19.	Seattle, Wash.	Nov. 1
Nov. 19.	Brewton, Ala.	Nov. 1
Nov. 20.	Holdredge, Neb.	Nov. 1
Nov. 22.	Hindman, Ky.	Oct. 25
Nov. 23.	Kendallville, Ind.	Oct. 25
Dec. 4.	Tuscumbia, Ala.	Nov. 8

Bids Close		See Eng. News-Record

EXCAVATION AND DREDGING

Nov. 10.	Somers, Wis.	Nov. 8
Nov. 12.	Havana, Ill.	Nov. 1
Nov. 12.	Clarion, Ia.	Nov. 8
Nov. 13.	Granite Falls, Minn.	Nov. 1
Nov. 15.	Garden Prairie, Ill.	Nov. 1
Nov. 15.	Dover Twp., Ont.	Nov. 8
Nov. 16.	Madison, Wis.	Nov. 1
Nov. 22.	Glenwood, Minn.	Nov. 8
Nov. 22.	Memphis, Mo.	Nov. 8
Dec. 6.	Marion, O. ..... Adv. Nov. 8.	Nov. 8

INDUSTRIAL WORKS

Nov. 14.	Central Islip, N. Y. ..... Adv. Nov. 8.	Nov. 8

BUILDINGS

Nov. 12.	Eldorado, Tex.	Nov. 1
Nov. 12.	Cleveland, O.	Nov. 1
Nov. 12.	Tallahassee, Fla.	Nov. 1
Nov. 12.	Sapulpa, Okla.	Nov. 8
Nov. 12.	Eldorado, Kan.	Nov. 8
Nov. 13.	Red Bank, N. J.	Nov. 8
Nov. 13.	Palo Alta, Cal.	Nov. 1
Nov. 14.	Lewiston, Me.	Nov. 8
Nov. 15.	Northampton, Mass.	Oct. 25
Nov. 20.	Pleasant Plain, Ia.	Nov. 8
Nov. 25.	Middletown, Mass.	Oct. 4
Dec. 1.	Norfolk, Va.	Sept. 13
Dec. 1.	Glenville, W. Va.	Nov. 8

FEDERAL GOVERNMENT WORK

Nov. 10.	Levee Work — New Orleans, La.	Nov. 8
Nov. 10.	Levee Work — Vicksburg, Miss.	Nov. 8
Nov. 12.	Storehouse — Washington, D. C.	Nov. 8
Nov. 12.	Emergency Camp — Gulfport, Miss.	Nov. 8
Nov. 12.	Emergency Hospital—Gulfport, Miss.	Nov. 8
Nov. 12.	Addition to Forge Shop—Washington, D. C.	Nov. 8
Nov. 12.	Heating, Plumbing and Lighting—Chelsea, Mass.	Nov. 8
Nov. 12.	Emergency Hospital—Brooklyn, N. Y.	Nov. 1
Nov. 13.	Piles, Walling and Lumber —New Orleans, La. .... Adv. Nov. 1 and 8.	Nov. 1
Nov. 13.	Post Office—Harrisonville, Mo.	Oct. 11
Nov. 14.	Post Office—Austin, Tex. .	Oct. 11
Nov. 15.	Canals—El Paso, Tex. ... Adv. Oct. 18.	Oct. 18
Nov. 16.	Maneuver Boats — Wheeling, W. Va. ..... Adv. Oct. 18 to Nov. 8.	Oct. 18
Nov. 19.	Fitting out Cranes—Washington, D. C.	Oct. 18
Nov. 19.	Shipbuilding Ways — Brooklyn, N. Y.	Oct. 25
Nov. 19.	Electric Elevator—Norfolk, Va.	Nov. 1
Nov. 19.	Refrigerating Plant and Brine Circulating System—Washington, D. C..	Nov. 1
Nov. 19.	Timber Bulkheads, Boston, Mass.	Nov. 1
Nov. 19.	Filling—Key West, Fla. ..	Nov. 8
Nov. 19.	Bulkhead—Boston, Mass. .	Nov. 8
Nov. 20.	Bridge—Washington, D. C.	Nov. 1
Nov. 20.	Post Office—Caribou, Me. .	Oct. 18
Nov. 22.	Post Office—Basin, Wyo. .	Oct. 25
Nov. 23.	Post Office -- Woodbury, N. J.	Oct. 25

Bids Close		See Eng. News-Record
Nov. 26.	Dry Dock Crane, Wash., D. C.	Oct. 25
Nov. 26.	Steel Towers—Washington, D. C.	Nov. 1
Nov. 26.	Electric Duct System — Charleston, W. Va.	Nov. 8
Nov. 26.	Radio Building—New Orleans, La.	Nov. 8
Nov. 26.	Reservoir — Philadelphia, Pa.	Nov. 8
Nov. 26.	Electric Generating System, Ft. Stanton, N. M... Adv. Nov. 8.	Nov. 8
Nov. 27.	Post Office—Chapel Hill, N. C.	Oct. 25
Nov. 27.	Stone—New Orleans, La. . Adv. Nov. 1 and 8.	Nov. 1
Nov. 28.	Post Office — Bellefourche, S. D.	Oct. 11
Nov. 30.	Post Office—Buffalo, Wyo. Adv. Nov. 1.	Nov. 1
Nov. 30.	Machinery, etc. — Cincinnati, O. ..... Adv. Nov. 1 and 8.	Nov. 1
Dec. 5.	Post Office—Decatur, Ala.	Nov. 1
Dec. 5.	Bulkhead — New Orleans, La.	Nov. 8
Dec. 10.	Foam Fire Protection — Guantanoma, Cuba	Nov. 8
Dec. 17.	Post Office—Denton, Tex..	Nov. 8
Dec. 18.	Laterals — Torrington, Wyo.	Nov. 1

MISCELLANEOUS

Nov. 10.	Roof Repairs — Elmira, N. Y. ..... Adv. Nov. 8.	Nov. 8
Nov. 13.	Channel Improvements — Columbus, O. ..... Adv. Oct. 25.	Oct. 25
Nov. 15.	Pumping Machinery — Brockton, Mass. ..... Adv. Oct. 25 to Nov. 8.	Oct. 25
Nov. 15.	Flood Control—Dayton, O. Adv. Sept. 13 to Oct. 18.	Sept. 13

Where name of official is not given, inquiries should be addressed to City Clerk, County Clerk or corresponding official.

WATER-WORKS

Proposed Work

Wis., Hartford—City plans to issue $15,000 bonds to build water-works.

Wis., Tomahawk—City having plans prepared by R. W. Richardson, engr., 476 Laurel Ave., St. Paul, Minn., for improvements to water-works system, including 20 x 25-ft. pumping station and electrically driven centrifugal pump, 300 gal. per minute capacity. About $20,000. Noted Oct. 11.

Kan., El Dorado—City sold $60,000 bonds to build water-works system. W. H. Betz, supt.

Kan., Winfield—City to issue $129,000 bonds to build new water-works system. J. M. Bradley, city engr.

S. D., Alpena—City plans bond issue to build water-works system.

S. D., Mitchell—(Official)—City defeated $125,000 bonds to improve water-works. Noted Oct. 25.

Mo., Kansas City—City plans to issue $50,000 bonds to build pumping station in East Bottoms. C. Hill, city engr.